

**PREVALENCE OF PERIPHERAL ARTERIAL DISEASE AND ERECTILE
DYSFUNCTION AMONG AMBULANT HYPERTENSIVE MALES AT KENYATTA
NATIONAL HOSPITAL**

**INVESTIGATOR:
DR. MALCOLM COLIN CORREIA
M.B.Ch. B (UON)
REGISTRATION NO – H58/68896/2013**

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DECLARATION OF ORIGINALITY

Name of the student: Dr. Malcolm Colin Correia

Registration Number: H58/68896/13

College: Health Sciences

School: Medicine

Department: Clinical Medicine and Therapeutics

Course name: Master of Medicine in Internal Medicine

Title: Prevalence of peripheral arterial disease and erectile dysfunction among ambulant hypertensive males at Kenyatta National Hospital

DECLARATION

I declare that this dissertation is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.

Signature.....

Date.....

SUPERVISORS' DECLARATION

This dissertation has been submitted with our approval as research supervisors:

Prof. Ogola Elijah S.N.,
M.B.Ch.B, M.Med (Internal Medicine), Cert.Trop.Med (Nbi),
Fellow American College of Cardiology (FACC).
Associate Professor, Consultant Cardiologist,
Department of Clinical Medicine and Therapeutics,
School of Medicine, College of Health Sciences,
University of Nairobi, Kenya

Signed

Date

Prof. Kayima J.K.,
M.B.Ch.B., M.Med (Internal Medicine)
Associate Professor, Consultant Nephrologist,
Department of Clinical Medicine and Therapeutics,
School of Medicine, College of Health Sciences,
University of Nairobi, Kenya

Signed

Date

Prof. Joshi Mark D.,
M.B.Ch.B.; Mmed (Internal Medicine), Cert Trop Med; Cert Clinical Epi, Mph Epidemiology,
Fellow American College of Cardiology (FACC)
Associate Professor, Consultant Physician/Cardiologist,
University of Nairobi, Kenya

Signed

Date

Dr. Silverstein David M.
MD, Fellow American College of Physicians (FACP),
Fellow American College of Cardiology (FACC)
Consultant Physician/Cardiologist,
The Nairobi Hospital
Nairobi, Kenya

Signed

Date

DEDICATION

To my wife and family, you are the sun that my world revolves around.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABI	Ankle brachial index
ACE	Angiotensin-converting enzyme
ACEi	Angiotensin converting enzyme inhibitors
ARB	Angiotensin receptor blocker
CCB	Calcium channel blocker
BMI	Body mass index
BP	Blood pressure
CAD	Coronary artery disease
CC	Corpus cavernosum
CLI	Critical leg ischaemia
CVD	Cardiovascular disease
ED	Erectile dysfunction
eNOS	Endothelial nitric oxide synthase
ECQ	Edinburgh claudication questionnaire
ESH	European society of hypertension
ESC	European society of cardiology
ET	Endothelin
HDL	High density lipoprotein
IC	Intermittent claudication
IIEF	International index of erectile function questionnaire

KNH	Kenyatta national hospital
LDL	Low density lipoprotein
MI	Myocardial infarction
MMAS	Massachusetts male aging study
MOPC	General medical out-patient clinics
NCEP	National cholesterol education program
NO	Nitric oxide
PAD	Peripheral arterial disease
PI	Principal Investigator
PDE-5	Phospho-diesterase-5
SPSS	Statistical package for social sciences
SHIM	Sexual health inventory for men
UON	University of Nairobi
WHO	World health organization
WHR	Waist-hip ratio

ABSTRACT

Background

Hypertension affects 22% of the world's population and is a risk factor for cardiovascular disease (CVD) including stroke and coronary artery disease (CAD) partly due to atherosclerosis. The underlying pathophysiological link between hypertension, peripheral arterial disease (PAD) and vasculogenic erectile dysfunction (ED) is endothelial dysfunction. The common risk factors for PAD and ED for atherosclerosis include hypertension, age, cigarette smoking and hazardous alcohol consumption. The worldwide prevalence of PAD is estimated to be up to 29% and is an independent risk factor for cardiovascular morbidity and mortality. The association between ED and PAD has been confirmed in several studies with prevalence of ED reported as high as 68% in hypertensive patients and is associated with a two-to-fivefold increase in mortality. The aim of this study was to investigate the prevalence of PAD and ED, explore their correlation and associated risk factors among male hypertensive patients.

Objective

Determine the prevalence of peripheral arterial disease and erectile dysfunction, their associations and their correlation among ambulant hypertensive males at the Kenyatta National Hospital.

Methods

In this hospital-based cross-sectional study 385 ambulant hypertensive male patients at the Kenyatta National Hospital (KNH) on follow up in medical outpatient clinics were enrolled into the study. After giving informed consent to participate in the study were enrolled consecutively by convenience sampling. A targeted clinical history and physical examination was performed and data was entered into standardized questionnaires. PAD was determined using ankle brachial index (ABI) measurement and International Index of Erectile Function (IIEF-5) questionnaire was administered to assess the presence and severity of ED.

Results:

The prevalence of PAD was 49.9% (95% CI 44.7-55.1%) with an increase in prevalence above age 50 years. The prevalence of ED was 94.5% (95% CI 92.2-96.6%) without a significant change in prevalence due to age. History of smoking had a prevalence of 54.2% and was

associated with nearly two-fold risk of PAD (OR 1.8 (95% CI 1.2-2.7), $p=0.005$) but was not significant in ED. Fourteen percent of patients had hazardous alcohol consumption showing a protective benefit in PAD (OR 0.6) and ED (OR 0.7) but was not statistically significant. The duration of hypertension from diagnosis was not significantly associated with PAD or ED. An elevated waist-hip ratio was noted to be protective with an OR 0.4 (95% CI, $p<0.001$) in PAD though not significant in ED. There was an agreement on McNemar's testing that demonstrated correlation between ED and PAD with 50.8% ($p<0.001$) patients who had ED likely to have PAD.

Conclusion:

There is an increased prevalence of PAD and ED among male hypertensive, non-diabetic population. A positive cigarette smoking history was associated with. In this study a significant concordance exists between ED and PAD which may demonstrate the increased population at risk of atherosclerotic disease. These findings may be used justify the use of ED screening to identify patients who may require assessment for PAD in order to have early detection, prevention, and management in order to prevent progression of PAD and improve quality of life.

Key words: Peripheral arterial disease, erectile dysfunction, hypertension, cigarette smoking, hazardous alcohol consumption, correlation between Peripheral arterial disease and erectile dysfunction, PAD and ED.

1.0 INTRODUCTION

The prevalence of hypertension was estimated at 22% globally in 2014. Almost 30% prevalence in men above 18 years of age in low income countries compared to about 25% in high income countries (1). In Africa, the prevalence of hypertension reported is up to 35% in adults aged 25 to 64 years and increases with advance in age (2). About three in ten men over 18 years of age have hypertension in Africa (1). The 2014 WHO estimates showed between 25% and 29.9% prevalence of hypertension among adult males in Kenya (1). However, lower prevalence figures have been reported in studies locally. A study in a population in a major Kenyan slum reported a prevalence of hypertension of 12.6% among males and a majority did not know they were hypertensive and were not aware of the complications (3, 4).

Hypertension is a major contributor to the burden of non-communicable disease in both developing and developed countries (5) and was estimated at 7% of disease burden in 2010 (1). Morbidity due to cardiovascular disease (CVD) is associated in a large extent to uncontrolled hypertension (6). CVD in hypertensive patients due to atherosclerosis manifests in different vascular beds by impeding blood flow. This leads to organ damage including atherothrombotic and haemorrhagic stroke, coronary artery disease (CAD), hypertensive heart failure, peripheral arterial disease (PAD), hypertensive kidney disease, erectile dysfunction (ED), retinal haemorrhage and visual impairment (2). Due to the complications of CVD, hypertension is ranked as one of the leading risk factors for global mortality causing about 13.5% of all deaths worldwide (7).

Peripheral arterial disease (PAD) affects 27 million people in Europe and North America (8). PAD manifests more commonly as intermittent claudication in about 2-5% of hypertensive patients and is associated with a two-to-five-fold increase in mortality (8). Therefore, early detection and management of PAD is important in reducing this associated mortality. Detection of PAD is widely done using the ankle brachial index (ABI) which is a non-invasive test. A low ABI is associated with a 2–6-fold increase in cardiovascular mortality (9). Despite the prognostic and therapeutic implications of making the diagnosis of PAD and published recommendations for office-based ABI screening, PAD frequently goes undiagnosed. This is primarily due to limited awareness of the disease and a high frequency of asymptomatic PAD (10, 11).

Erectile dysfunction (ED) is estimated to affect approximately 100 million men worldwide and in the U.S. 52% of the men aged 40–70 years are affected (12). ED was first described as age-related and until the late 20th century and primarily thought to be a psychogenic disorder. Recently, it has

been recognized as a physiologic and organic abnormality affecting the penile vascular circulation as part of a more generalized vascular disorder (13-15). There is increasing evidence of a strong link between ED and atherosclerosis due to similar risk factors including hypertension, diabetes mellitus, smoking, obesity, and dyslipidaemia (16, 17). Both ED and atherosclerosis are characterized by endothelial dysfunction and impaired nitric oxide bioavailability (17, 18). Data suggesting that ED may serve as a sentinel marker that comes before the clinical diagnosis of atherosclerotic vascular disease, it is considered an independent predictor of possible future adverse cardiovascular events. This is because many men experience ED symptoms years before their first diagnosis of cardiovascular disease (19, 20). Therefore, ED could be the first clinical manifestation of atherosclerosis before the onset of PAD and CAD (15). It is against this background that this study is designed to investigate PAD and ED prevalence and their concordance rates in hypertensive patients.

2.0 LITERATURE REVIEW

2.1 Peripheral arterial disease (PAD)

The American Heart Association (AHA) defines peripheral arterial disease (PAD) as narrowing of the peripheral arteries mostly those leading to the legs but also to the stomach and arms. Therefore, PAD occurs when there is narrowing of the arteries other than those in the heart or the brain (21). Up to 50% of PAD cases are asymptomatic but commonly presents as intermittent claudication (IC) described as pain in the leg when walking which resolves with rest. Other symptoms including skin ulcers, bluish skin, cold skin, or poor nail and hair growth may occur in the affected leg. Besides being a marker of elevated risk of coronary artery disease and stroke, PAD complications may include infection or tissue death leading to gangrene and amputation of the limb (9). Risk factors of PAD in the population have been identified and include hypertension, diabetes, advanced age, dyslipidaemia and cigarette smoking (22).

2.1.1 Pathobiology of Peripheral Arterial Disease

In 90% of cases in the US, peripheral arterial disease (PAD) results from atherosclerosis. Atherosclerosis is a disease in which plaque, made up of deposits of fats, cholesterol and other substances, builds up in the wall of an artery. Atherosclerosis leads to narrowing of the arterial lumen resulting in partial or total occlusion. This compromise in blood flow presents as pain in one or more muscle groups distal to the obstruction (23). Symptoms of PAD are determined by the presence of collateral circulation, metabolic demand of the affected ischemic tissue during exercise and location of the affected artery. PAD is classified into symptomatic disease and asymptomatic disease. Symptomatic disease is associated with a two-fold increase of all-cause mortality and major cardiovascular events (myocardial infarction and stroke). Symptomatic disease presents with intermittent claudication, leg pain or critical leg ischaemia. Intermittent claudication presents with aching pain, numbness or fatigue in the affected muscle. Vascular disease may manifest acutely when compromised perfusion occurs due to thrombosis, emboli, or trauma (23). Up to 50% of patients are asymptomatic and this qualifies the need for diagnostic tools like the Ankle-Brachial Index (ABI) to identify these patients (24).

2.1.2 Epidemiology of Peripheral Arterial Disease (PAD)

Approximately 200 million people live with PAD globally with prevalence shown to be increasing with advancement in age. In Europe and North America 27 million people are affected by PAD. The prevalence of PAD is higher in high income countries compared to the low and middle income countries attributed to higher rates of smoking, metabolic syndrome, obesity, DM and

sedentary lifestyle (23). In the sub-Saharan Africa, studies have shown PAD prevalence of up to 24% in adults aged 50 years and older (24). A study in Ghana reported PAD prevalence of 8.1% in a non-diabetic group of patients (25). In Kenya, there is paucity of data on PAD in hypertensive patients. One study in Kenyatta National Hospital found the prevalence of PAD in patients with rheumatoid arthritis to be 25% (26) while another study done on type 2 diabetic patients, found a significant association with a prevalence of 73% (27). Another study done at Kenyatta National Hospital on peripheral arterial disease in chronic kidney disease patients showed a prevalence of 11.9% (28).

2.1.2 Risk factors for peripheral arterial disease

i. Hypertension, cardiovascular disease and PAD

Hypertension is a major risk factor for cardiovascular disease (CVD). Epidemiological data from the WHO global health observatory shows that the risk of CVD rises with increasing blood pressure (BP) levels ($\geq 115/75$ mmHg). Clinical trials have also shown that lowering BP reduces cardiovascular risk by 20% - 25% for myocardial infarction (MI), 35%- 40% for stroke and by 50% for heart failure (25). Hypertension contributes to the pathogenesis of atherosclerosis which is the basic pathological process underlying PAD (29). Patients who suffer from hypertension and also PAD have a greatly increased risk of MI and stroke compared to those without (29). Studies have shown increased prevalence of PAD in hypertensive patients. In a study done in Italy, the prevalence of arterial hypertension in PAD patients was significantly greater than non-PAD patients (51.9 vs. 9.8%) (30). The Italian study is in keeping with follow-up data from the Framingham Study found a 2.5 to 4-fold increased risk of PAD in men with hypertension (31).

ii. Peripheral arterial disease and diabetes mellitus

Diabetes mellitus (DM) increases the risk of CV morbidity and mortality. Diabetes is associated with a 1.5 and 4 fold increased risk of developing symptomatic and asymptomatic PAD respectively (30). The risk of atherogenesis is increased in DM due to endothelial dysfunction, increased hypercoagulable state, increased blood viscosity and fibrinogen levels (32). In the 1999-2004 NHANES, data from 7,571 participants aged 40 years and above was analysed. 636 patients had PAD defined by ABI of less than 0.9 with 26% of these patients identified as having diabetes (33). A study among diabetic patients in Uganda reported a prevalence of PAD 24% (34). In the study done by Ngalyuka et al. in Kenya at the Kenyatta National Hospital, prevalence of 66.5% was noted in the diabetic patients compared to 36.9% in non-diabetic control group (27).

iii. Peripheral arterial disease and age

Prevalence of peripheral arterial disease increases with age. The Framingham Heart Study showed the prevalence of PAD increasing 10-folds in men aged more than 65 years compared to younger men aged 30-44 years (31). A USA study also showed a stepwise increase in the prevalence of any type of PAD among individuals aged 40-59 years, 60-69 years and >70 years at 3%, 8% and 19% respectively (35).

iv. Peripheral arterial disease and dyslipidaemia

Elevated total cholesterol increases the risk for PAD. Patients who ultimately develop intermittent claudication (IC) tend to have higher levels of cholesterol compared to asymptomatic subjects (34, 36). It has also been reported that PAD patients are more likely to be diagnosed with lipid abnormality than patients with CAD and more often have low high density lipoproteins (HDL) and hypertriglyceridaemia (37).

v. Peripheral arterial disease and lifestyle choices

Willigendael EM et al found PAD was increased 2.3-fold in current smokers. In former smokers the prevalence increased by a factor of 2.6. A clear dose-response relationship, with a strong increase in risk for PAD in heavy smokers was observed (38). In the Turkish study smoking was more frequent (30% of the population) among PAD patients than non-PAD patients (27.5%) (39).

In a Mediterranean population moderate alcohol consumption was associated with a lower prevalence of the metabolic syndrome, PAD, DM, CHD and overall CVD but not stroke when compared with no alcohol use. Conversely, heavy alcohol consumption was associated with an increase in the prevalence of PAD, DM, metabolic syndrome and CHD (40).

2.2 Erectile Dysfunction (ED)

Erectile dysfunction (ED) is defined by the National Institute of Health as the persistent inability to achieve and then maintain an erection to permit satisfactory sexual intercourse (12).

2.2.1 Pathogenesis of Erectile Dysfunction in Hypertensive patients

One of the earlier steps in atherosclerosis which contributes to hypertension is endothelial dysfunction which precedes ultrasonographic, angiographic, and clinical evidences of vascular disease (41). In comparison to larger arterial networks like coronaries, small cavernosum arteries are thought to be more vulnerable to endothelial dysfunction. This would explain why ED precedes angina in a patient with systemic vasculopathy (42).

ED symptoms in hypertensive patients would represent deterioration in endothelial dysfunction

already present and should alert for a possible progression of a systemic vasculopathy (43).

Endothelial function in hypertensive patients has been demonstrated to have an inverse relationship with accumulation of asymmetric dimethylarginine (ADMA) which is a competitive inhibitor of endothelial nitric oxide synthase (eNOS) and L-arginine (42). Oxidative stress and endothelial cell injury due to long-standing hypertension may cause inability of corpus cavernosum arteries, arterioles, and sinusoids to dilate properly (44). The ADMA accumulation also leads to hypertensive men having higher carotid intima-media thickness, higher levels of serum inflammatory mediators, and lower brachial flow-mediated dilation than normotensive people with similar cardiovascular risk (45).

2.2.2 Risk factors for development of erectile dysfunction

The common risk factors for ED include neuro-psychosocial, hormonal, anatomical, drug related causes and aging (27, 46).

i. Erectile dysfunction and Hypertension

It has been estimated that the possibility of developing erectile dysfunction is up to seven-fold higher in hypertensive patients compared to normotensive individuals, with relative risk ranging from 1.3 to 6.9 (47). However, another study indicated that erectile dysfunction was almost two fold more in hypertensive patients and was of greater severity (48). A United States of America (USA) study documented an ED prevalence of 68% in hypertensive men (49).

Because the vascular tissue is the main contributor to penile erection, structural and/or functional abnormalities of the penile vessels may impair the ability to achieve an erection and represent the underlying cause of sexual dysfunction in the vast majority of male hypertensive patients (50). Hypertension is responsible for stenotic lesions secondary to atherosclerosis, smooth muscle hypertrophy of the cavernosum arteries and blood flow impairment in the penile vasculature. This provides evidence for a direct causative link between hypertension and erectile dysfunction (51).

ii. Erectile dysfunction and antihypertensive medication

The association between ED and hypertension may involve the haemodynamic interferences caused by antihypertensive drugs (52). In a Nigerian study 74.07% of newly diagnosed non-treated hypertensive men had some degree of ED, while prevalence in those on any antihypertensive treatment was 86.20% showing an increase in ED in the treatment group independent of age and other co-morbidities (53). The study done by Baumhake et al. showed only thiazide diuretics and beta-blockers, not including nebivolol, may influence erectile function

negatively. ACE inhibitors, angiotensin receptor blockers (ARB), and calcium channel antagonists were reported to have no relevant negative effect and in some cases were shown to improve erectile function (54). The mechanisms of anti-hypertensives causing a negative effect of erectile function vary from central-acting sympatholytics, depression of libido as well as hypotension and thus a higher blood flow pressure requirement to achieve erection in atherosclerotic in patients taking diuretics and vasodilators. Development of erectile dysfunction in connection with beta-blockers might also be biased by psychological effects derived from the awareness of being treated with a certain substance. This is an important point since patient concerns about the adverse effects of drugs on erectile function might limit the use of essential medications in cardiovascular high-risk patients (55). Even though thiazide diuretic and beta-blocker therapy are more likely to contribute to ED, almost all antihypertensive medications have been implicated in erectile dysfunction (56). These studies suggest that depending on the class of the antihypertensive drug and its effect over endothelium mediators, the impact on ED could be positive or negative.

iii. Erectile dysfunction and age

There is a well-defined age related increase in ED prevalence in the general population. Chew et al. reported that 9% of 20- to 29-year olds and as high as 76% of those 80 years or older Australian men had ED of some degree (57). Similarly, in a Brazilian study, the incidence of ED was 33/ 1,000 person years among 40 to 49-years-old men and 190/ 1000 person years among 60- to 70-years-old men (58). The higher levels in older men was also reported in an American study where it was found that the prevalence of ED in men aged 40 – 70 years was as high as 52% (59). An African study in northern Kenya had similar findings with men aged 60 years and older having significantly higher erectile dysfunction than younger men (60).

iv. Erectile dysfunction and diabetes

In an evaluation of the prevalence and risk factors for ED in the United State, men with diabetes had a crude prevalence of erectile dysfunction of 51.3% (46). However, a Kenyan study found ED was found to be five times more prevalent in diabetic males compared to age-matched controls. A prevalence of 73% in diabetic patients was found to have ED compared to 15.1% in on diabetic controls. Advancing age, duration of diabetes, poor glycaemic control, history of hypertension, use of antihypertensive drugs, and presence of peripheral neuropathy and evidence of peripheral arterial disease were associated with ED in male diabetics (27). This large difference may be suggestive of the unmet burden of disease that exists in our population.

v. Erectile dysfunction and smoking

Apart from the various inhaled toxins that promote the narrowing of blood vessels, nicotine has a direct effect on the blood vessels which carry blood to the penis. This causes the blood flow to be reduced which makes getting and keeping an erection more difficult. After adjusting for age, alcohol drinking, physical activity, hypertension, diabetes, dyslipidaemia, and obesity, a Chinese study reported that those who smoked ≥ 20 cigarettes daily had a significantly increased risk of ED than never smokers. After further adjustment for education, the risk of ED was still significantly higher in men smoking more than 23 years than never smokers (61).

vi. Erectile dysfunction and alcohol consumption

In the cross-sectional Health Professionals Follow up Study of ED in 22,086 men aged 40–75, the multivariate-adjusted relative risk for ED were decreased with moderate levels of alcohol consumption after adjusting for co morbidity, medication, smoking status, physical activity, television watching, body mass index (BMI) and other factors (62). In the meta-analysis by Cheng et al., a protective effect was found with low and moderate non-hazardous intake of less than 7 alcoholic drinks per week. Hazardous alcohol intake of more than 8 alcoholic drinks per week had a less protective effect. The results showed a similar relationship of alcohol consumption to cardiac survival (63).

vii. Erectile dysfunction and obstructive sleep apnoea

Erectile dysfunction is highly prevalent in patients suffering from obstructive sleep apnoea. There exists an association with obesity and increased prevalence of atherosclerosis in these patients (64).

viii. Erectile dysfunction and renal disease

In a study conducted to determine the prevalence of ED and associated variables in patients with chronic renal failure (CRF), the prevalence of ED was 57.9% (65). Recipients of kidney transplant had a high prevalence of ED at 48.9%. Patients with end stage renal disease (ESRD) were reported to experience disturbances in erectile function related to other organic factors such as uraemia, hypertension, endocrine disturbances, and non-organic factors like depression (66).

ix. Erectile dysfunction and psychogenic causes

Erectile dysfunction can be as a result of relationship stress, performance anxiety, or overt psychological disorders, such as schizophrenia or depression (56). Predisposing factors likely to precipitate loss of libido and sexual dysfunction, include poor sex education, traumatic or abusive experiences, social pressures, and other life events like deaths in the family (67).

x. Erectile dysfunction and neurogenic causes

Injuries or disorders of the central nervous system and spinal cord, depending on the nature, location and extent, can negatively affect initiation and maintenance of erection (68). Reflexogenic erection can be inhibited by any sensory impairment of the genitalia. Radical pelvic surgery can lead to cavernous nerve injury intraoperatively. Other disorders such as multiple sclerosis, Alzheimer's disease or Parkinson's disease are frequently associated with ED (67).

xi. Erectile dysfunction and hormonal imbalances

Androgen deficiency causes decreased libido, erectile and ejaculatory function (67). Nitric oxide synthase and phosphodiesterase-5 expression is regulated by testosterone which also maintains the integrity of the vascular smooth muscle and endothelium. The common causes of androgen deficiency are due to testicular disorders and dysregulation of the hypothalamic-pituitary axis (41). Low testosterone levels also affect the level of sexual performance and overall sexual function including desire, initiation and maintenance also contributing negatively to fertility (69).

2.3 Association of erectile dysfunction and peripheral arterial disease

Montorsi et al. studied the time of onset and prevalence of ED in patients sent for coronary angiography. In this study 70% of patients with angiographically documented coronary artery disease had erectile dysfunction prior to angina symptoms (19). Selvin et al demonstrated an ED prevalence of 77.5% in men over 75 years of age had similar risk factors for PAD including diabetes (OR 2.69), obesity (OR 1.60), smoking (OR 1.74) and hypertension (OR 1.56) (46).

Polonsky et al. found that men with ED had significantly more PAD than men without ED (32% vs. 16%, $p < 0.01$). Notably there was a stepwise increase in the prevalence of PAD with increasing ED severity (28% of men with mild ED, 33% with moderate ED, 40% with severe ED, $p < 0.001$). On multivariate logistic regression analysis, ED was an independent predictor of PAD. The study concluded that in men referred for stress testing, erectile dysfunction was an independent predictor of PAD as determined by screening ABI examination (70).

2.4 Tool used in this study to assess Peripheral Arterial Disease (PAD)

2.4.1 Ankle Brachial Index (ABI)

The ABI is a reproducible method to assess arterial blood flow impairment in the lower limbs and predict the presence of peripheral arterial disease (71). Measurements can be taken before and after stress testing to assess the functional limitation. It is done by measuring the blood pressure of the arm and the ankle of an individual at rest. The ankle BP is then divided by the arm BP to

calculate the index. The normal vascular compressibility measured by ABI is over 1.00 and a typical cut point to diagnose PAD is ≤ 0.90 at rest (72). ABI can confirm the diagnosis of PAD, detect PAD in asymptomatic (sedentary) patients, help in differentiating PAD from other causes of leg symptoms, identify patients with reduced limb function, provide key information on the long term prognosis and provide further risk stratification in patients at a cardiovascular risk. It should be measured in all patients with exertional leg symptoms and aged between 50-69 with a cardiovascular risk factor (particularly diabetes or smoking). In addition, ABI should be measured in all patients aged ≥ 70 years regardless of the risk factor status and with a Framingham risk score from 10% to 20% (73).

In the different threshold levels of ABI the specificities in identifying PAD have been estimated to be 86% (ABI 1.3), 94% (ABI 1.4) and 96% (ABI 1.5). The corresponding sensitivities were 44%, 38% and 36%, respectively (72). In these patients, additional non-invasive diagnostic testing (toe pressures or toe brachial index) should be performed to evaluate the patient for PAD (73).

2.5 Tool used to in this study to assess Erectile Dysfunction (ED)

2.5.1 International Index of Erectile Function (IIEF)

The IIEF-5 questionnaire is a psychometrically valid and reliable instrument developed by an international panel of experts. The questionnaire is a validated, multi-dimensional; operator and self-administered investigation used in the clinical assessment of erectile dysfunction and treatment outcomes. The tool consists of 5 domains assessing 15 items on erectile function and orgasmic function and are considered to reflect the physical findings and sexual desire, intercourse satisfaction, and overall satisfaction which reflect the psychological factors (74). The tool provides scoring of patients with the lowest score being 5 and the highest 25. A score of 21 and above indicates no ED and a score of 11 or less indicates moderate to severe ED. The sensitivity of the IIEF-5 questionnaire has been noted to be 98% and 88% specific (74). IIEF-5 tool has been used in several studies in the region and in different languages including Kiswahili (27, 74).

2.6 Study justification

Peripheral arterial disease (PAD) is an established early marker of coronary artery disease (CAD) that increases in patients with hypertension. ED is thought to serve as a possible sentinel marker for cardiovascular disease due to shared risk factors although also influenced by psychogenic and drug interactions.

There exists a common pathophysiological process leading to endothelial dysfunction that is noted in ED, PAD and CAD. Since CAD, PAD and ED have common risk factors including and not limited to hypertension, genetics, ethnicity, diet and environmental factors such as cigarette smoking, this study will give data on the local population and bridge the paucity of data on PAD and ED in male hypertensive patients.

As compared to other methods of detecting subclinical atherosclerosis such as coronary angiography, coronary artery calcium and carotid intima media thickness, ABI measurement is a simple, non-invasive procedure that can be performed in the clinician's office to diagnose subclinical atherosclerosis disease.

The presence and severity of ED can be assessed using the International Index of Erectile Function (IIEF-5) which is a quick, inexpensive and non-invasive method, which does not require specialized skills or equipment, and may act as a surrogate for ABI.

Therefore, the findings of this study will provide insight into the burden of PAD and ED in male hypertensive patients. The data from this study will also provide insight on the prevalence of smoking and alcohol consumption and their effects on PAD and ED. The results of this study may provide a baseline for further studies into justifying a screening protocol using presence and severity of ED to identify patients for assessment of PAD in male hypertensive patients. This may enable early screening, investigation, intervention and prevention of PAD and by extension CAD.

2.7 Research question

What is the burden of peripheral arterial disease and erectile dysfunction in ambulant male hypertensive patients?

2.8 Objectives

2.8.1 Specific objectives

- i. To determine the prevalence of peripheral arterial disease as determined by the ankle brachial index to among ambulant hypertensive male patients.
- ii. To determine the prevalence of erectile dysfunction as determined by the International Index of Erectile Function (IIEF-5) among ambulant hypertensive male patients in the general medical outpatient clinic at Kenyatta National Hospital.
- iii. To determine the prevalence of cigarette smoking and alcohol intake among hypertensive male ambulant patients in the general medical outpatient clinic at Kenyatta National Hospital.

2.8.2 Secondary objectives

- i. Determine the association between peripheral arterial disease and: age, body mass index, waist-hip ratio, duration of hypertension, quantified cigarette smoking status and alcohol consumption among hypertensive male ambulant patients in the general medical outpatient clinic at Kenyatta National Hospital.
- ii. Determine the association between erectile dysfunction and: age, body mass index, waist-hip ratio, duration of hypertension, cigarette smoking status and alcohol consumption among hypertensive male ambulant patients in the general medical outpatient clinic at Kenyatta National Hospital.
- iii. To determine the correlation of peripheral arterial disease and erectile dysfunction among hypertensive male ambulant patients in the general medical outpatient clinic at Kenyatta National Hospital.

3.0 METHODOLOGY

3.1 Study Site

The study was conducted in Kenyatta National Hospital (KNH) and participants were recruited from the general medical out-patient clinics (MOPC). The KNH is the largest public referral hospital in Kenya and is located about four kilometres from the Nairobi city centre, off Ngong road on Hospital road. The current bed capacity for the hospital is 1800 and also offers outpatient services in the several specialized clinics within the hospital. The MOPC runs in the morning and afternoon, for four hours, on Monday, Tuesday and Thursday and in the morning on Wednesday to cater for new and follow up patients. The hospital receives patients referred from sub-county and county hospitals within the Kenya for specialized health care. In addition, it provides facilities for medical education and research, education and training in nursing and other health and allied professions. The annual patient volume of the hospital is about a half million and about 500 males are followed up in the MOPC monthly.

3.2 Study Duration

The study was performed over seven month period from January 2018 to July 2018. Participants were enrolled until study end point of sample size for recruitment into the study was achieved.

3.3 Study population

Ambulatory male hypertensive patients on follow up in the general medical out-patient clinics at the Kenyatta National Hospital during the study period.

3.4 Study design

Hospital based cross-sectional study.

3.5 Case definition

Ambulant patients attending MOPC with a file documented diagnosis of hypertension on antihypertensive medication and had been on follow up in the clinics for at least one month prior to the study enrolment. ED will be positively defined on the basis of a score of IIEF-5 of less than 21 and PAD will be defined as 'present' based on an ABI of less than 0.9.

3.6 Inclusion and Exclusion Criteria

3.6.1 Inclusion criteria

Ambulatory hypertensive male patients between the ages of 30 and 70 years

3.6.2 Exclusion criteria

- i. Non-consenting participants.
- ii. Participants with past history of vascular injury of peripheral vessels or any abnormality of the limb not allowing assessment ABI including amputation, or documented anatomical abnormalities of the genitalia.
- iii. Participants known to have diabetes defined by a patient file documented raised fasting blood sugar above 7 mmol/l or a random blood sugar above 11.1 mmol/l or a HBA1c more than 6.5% done within the last 6 months or are on medical treatment for diabetes.
- iv. Participants on documented gonadotrophin deprivation therapy or phosphodiesterase inhibitors.
- v. Patients with documented significant co morbidities including congestive heart failure stage 3 or 4, chronic kidney disease stage 4 or 5 or liver failure Child-Pugh B or C.
- vi. Patients will who are haemodynamically unstable or critically ill.

3.7 Sample size determination

This study was a study of ED and PAD in a single group of patients on follow up for hypertension in the hospital. Therefore, the sample size for estimating single proportion in a single group of participants was required for this study. The sample size formula for single proportions was used and the calculation was done using the Fisher's formula (92) as follows:

$$n = \frac{Z^2 \times P(1-P)}{d^2}$$

n – Sample size

Z – 1.96 (95% confidence interval)

P = Estimated prevalence of PAD in hypertensive patients (51.9%) or ED (68%)

d – Margin of error (precision error) set as 5%

Outcome	P	D	N
PAD (32)	51.9%	5%	384
ED (54)	68%	5%	334

Sample size therefore was taken on a minimum of 384 male hypertensive patients

3.8 Recruitment of the study participants

Recruitment occurred between 0700hrs to 1700hrs from Monday, Tuesday and Thursday and between 0700hrs and 1100hrs on Wednesday. The sampling frame was from the booked male patients in the MOPC. The principal investigator and trained medical research assistants perused the clinic booking register a day before the clinic and extract the medical files for all the male patients due for the clinic the following day. They also perused through the medical files for eligibility. All the eligible male patients had their file numbers written down as they appeared in the booking register. On the day of the clinic the nurses and house officers managing the patients were requested to direct male patients with hypertension to the principal investigator and medical research assistants once they are done with their clinic consultation.

The principle investigator and trained registered medical assistants sought informed consent from the patients that meet the inclusion criteria for enrolment into the study. Convenient sampling was used to sample patients into the study. This may lead to sampling bias as the sample may not be representative of the whole population.

3.9 Clinical methods

A brief clinical history and physical examination was performed. Demographic and clinical data collected and were recorded on standardized questionnaires (Appendix IIA): The patient medical file were inspected for a previous documented diagnosis on initial review and follow up of lipid profile and the test results recorded for analysis dyslipidaemia presence. Patients were asked for any family history of heart, liver, kidney and peripheral arterial disease and results will be recorded. A history of cigarette smoking status and history of alcohol consumption was taken. For anthropometric measurement height was measured to the nearest 0.5 cm using a metal measuring tape against a vertical divider and a flat headboard at right angles to the divider. Weight was measured to the nearest 100gms using a high quality weighing scale (Ashton Meyers®) with the patient in light clothing and without shoes. Waist circumference was taken with a flexible measuring tape placed on a horizontal plane at the midpoint between the superior border of the iliac crest and the inferior margin of the last rib mid-axillary plane and the recording done at the end of normal expiration. Hip circumference will be measured at the widest level over the greater trochanter. Body Mass index (BMI) was used as a measure of total body obesity while waist circumference and waist hip ratio was used as measures of abdominal obesity.

3.9.1 Determination of PAD using ABI

ABI was performed using an 8–Megahertz hand held Doppler device (Lifedop 250R- Summit Doppler). Participants were provided with information about the procedure to relieve any anxieties they may have. After removal of any tight fitting article of clothing, participants were asked to lie supine on the examination couch for a minimum of 5 minutes before the blood pressure measurements are taken.

The measurement of the brachial systolic blood pressure was done using a sphygmomanometer cuff of an appropriate size wrapped around the participant's upper arm above the elbow, the brachial pulse will be palpated and ultrasound gel applied. The Doppler probe was angled at 45 degrees to the direction of the blood flow (towards the heart) and the position adjusted to locate the best signal. The sphygmomanometer cuff was inflated about 20 mmHg above the point at which the audible continuous wave Doppler signal disappears. Then the cuff was slowly deflated and the pressure, at which the signal returns, recorded.

When measuring the ankle systolic pressure, an appropriately sized sphygmomanometer cuff was selected and placed around the leg 3cm above the medial malleolus. Then the posterior tibial artery was palpated, ultrasound gel applied and the best signal located using the Doppler probe. The sphygmomanometer cuff was inflated 20mmHg above the point at which the audible continuous wave Doppler signal disappears, then the cuff was slowly deflated and the pressure at which the signal returns recorded. The ABI of each lower limb was calculated by dividing the higher of the ankle pressure by the higher of the two systolic brachial pressures as shown below.

$$\text{ABI} = \frac{\text{Highest ankle systolic blood pressure}}{\text{Highest brachial systolic blood pressure}}$$

The lower of the two values calculated was used to define ABI for each individual.

3.9.2 International Index of Erectile Function (IIEF-5) questionnaire

This study used the abridged version (Appendix IIC) of the IIEF which was developed as a 5-item diagnostic tool for ED. The lowest score is 5 and the highest being 25 signifying rising severity. The questionnaire was administered to the patient and assistance offered by the principal investigator or medical research assistants when necessary.

3.10 Study Variables

3.10.1 Independent variables

- a) Age: Described in years as at last birthday.
- b) Hypertension duration from diagnosis: This was determined, in years, from checking the file documented date by year, of when the diagnosis of hypertension was made for the first time up to the time of this study.
- c) Antihypertensive Treatment: medication currently, used for more than 4 weeks, to control hypertension from the last file documented prescriptions.
- d) Relationship status: This was categorized as married, single, divorced or separated (with or without a regular sexual partner), and was documented as reported by the participant.
- e) Alcohol consumption – by using a standardized questionnaire (AUDIT-C) to classify by frequency of alcohol intake over the last 3 months into hazardous or non-hazardous alcohol use with a score above 4 for men being significant.
- f) Cigarette smoking – classified as smokers (current or quit < 5 years), former smokers (quit ≥ 5 years) or had never smoked.
- g) Body mass index (BMI) – Calculated as patient weight in kilograms (kg)/height in square meters), classified as:

< 18.5	underweight,	18.5-24.9	normal BMI,
$25-29.9$	overweight	>30	obese. (89)
- h) Significant waist circumference was recorded as more than 102 cm (40 inches). Significant waist circumference to hip circumference ratio was considered abnormal with a ratio of >0.9 (91).
- i) Family History of cardiovascular disease: Included previous family history in a first degree relative of angina, stroke, myocardial infarction inferring presence of premature atherosclerotic disease and risk of cardiovascular disease to the patient
- j) Dyslipidaemia: was defined as presence of any of the following: Total Cholesterol (TC) ≥ 5.17 mmol/l, High Density Lipoprotein (HDL-C) ≤ 1.03 mmol/l, Low Density Lipoprotein ≥ 3.34 mmol/l, Triglyceride ≥ 1.69 mmol/l (93) from any previous lipid profile recorded at least 4 weeks prior to the study as recorded in the patient file.

3.10.2 Dependent variables

1. **Peripheral Arterial Disease** – Measured by the ABI calculated and was categorized as follows:

Table 1: Scoring severity of PAD by use of ABI

Severity	ABI Score
Incompressible	>1.3
No PAD	1.0 - 1.2
PAD	< 0.99
Mild	0.71- 0.90
Moderate	0.41- 0.70
Severe	<0.40

2. **Erectile dysfunction:** Measured using the IIEF-5 questionnaire (Appendix III) and scored as in Table 2.

Table 2: Scoring severity of ED by use of IIEF-5

Severity	IIEF-5 Score
No ED	22-25
Mild ED	12-21
Moderate ED	8-11
Severe ED	5-7

3.11 Data management

3.11.1 Data collection and storage and cleaning

Completion of the questionnaires was verified by the principal investigator before the returning the medical records. The filled questionnaires were kept under key and lock by the investigator. Data was transferred from questionnaires to a MS Excel spread sheet for cleaning. The cleaned data was then exported to IBM SPSS (Statistical Package for Social Sciences) version 22 for statistical analysis. Back up for the data was done in an external hard drive and written on a compact disk (CD), and versatile compact disk (DVD). The PI had the only access to these back-ups.

3.11.2 Data analysis

Continuous variables presented as means or medians with standard deviations and interquartile ranges respectively. Frequencies and percentages were presented for categorical variables. Prevalence of ED and PAD was analysed and presented as proportions with 95% confidence intervals (CIs). Prevalence of cigarette smoking and alcohol intake was analysed and presented as proportions with 95% CIs. Association of PAD and ED with duration of hypertension, cigarette smoking status and alcohol consumption was done using Chi square test and odds ratios (ORs) reported to show magnitude of the risk. Medications prescribed including class of antihypertensive (alpha blockers, ACE inhibitors, ARB, beta blockers, calcium channel blockers, thiazide diuretics, non-thiazide diuretics) and other medications of significance (aspirin, warfarin, statins, allopurinol, antiepileptic and proton pump inhibitors) will be documented. Prevalence and severity of PAD and ED was stratified by age group, family history in a first degree relative of PAD, BMI, WHR, cigarette smoking status and alcohol consumption. Multiple logistic regression model was done to determine factors independently associated with ED and PAD while adjusting for effects of confounding. A value of $p < 0.05$ was considered statistically significant. Concordance rate for agreement of occurrence of PAD and ED in this study was tested using McNemar test.

3.12 Quality assurance

The English version of the International Index of Erectile Function (IIEF-5) has been translated backwards and forwards from Kiswahili to English with no loss in translation (31). Confidentiality was maintained throughout the interview process and filling of the IIEF-5 were under no pressure or coercion. For the ABI the 8-Megahertz hand held Doppler device (Lifedop 250R- Summit Doppler) was used and maintained according to the manufacturer's specifications. The PI and research assistants underwent training from one of the study supervisors, who had been trained to use the device, prior to performing the ABI. Research assistants underwent training on how to conduct anthropometric measurements to ensure standardization. The weighing scales were assessed weekly by taking measurements of a known standard weight to ensure standardization. The PI worked with the research assistants to ensure that data is collected efficiently, on time and that it is recorded accurately. All recorded data was verified by the PI, who ensured that all relevant forms were completed on a daily basis. The supervisors offered guidance to the PI throughout the process. The statistician offered guidance during data entry, analysis and presentation of the final statistical analysis.

3.13 Ethical consideration

The study was conducted in accordance with the declaration of Helsinki (1964) and ethical laws in profession. Consent and approval was obtained from the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee.

An introductory letter was included with the questionnaire to clearly describe the purpose of the study, the research team, voluntary nature of participation and confidentiality of the data. The objectives and purposes of the study were clearly explained to eligible participants in a language suitable to them prior to inclusion into the study. Only participants who gave informed consent to participate shall be enrolled. Information gathered from the study participants was kept confidential by assigning an anonymous study number to each study participant. This was the only identification appearing on the study questionnaire. Patients were free to withdraw from the study at any point without any discrimination.

Information obtained in this study is considered to be important in the management of the patient. Therefore, participants found to have ED or PAD will be provided with their results and shall be advised on follow up with their usual care giver at the medical outpatient clinic or any clinician of their choice.

All information collected onto the data collection tool was stored in a locked cabinet accessible only to the principal investigator. The information collected was used for the purposes of this study and will not be shared with any other persons and may be used for future studies. It will be stored for four years after completion of the study in the event of any need for verification, clarification purposes or further analysis. Upon the lapse of five years, the coded questionnaires will then be destroyed.

4.0 RESULTS

A total of 420 patients were screened over seven month duration between January and July 2018 in two periods. From January 2018 to February 2018 one hundred and thirty participants were enrolled and from June 2018 to July 2018 two hundred and ninety participants were enrolled. The hiatus in recruitment was due to restricted access of patients to the study site due to an ongoing industrial action. A sub-group analysis was done and showed no effect on final results. After excluding twenty patients with diabetes, eight were on regular haemodialysis for end stage renal disease, three for being on gonadotrophin replacement therapy and four who declined consent, 385 patients met the study inclusion criteria (Figure 1).

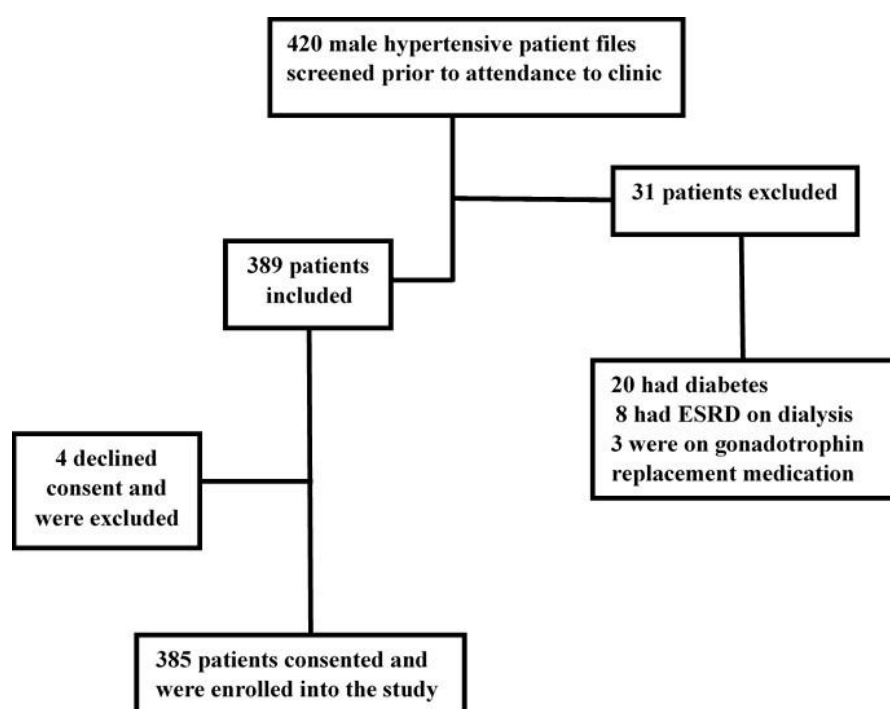


Figure 1: Flow chart of screening and enrolment of study subjects

4.1 Socio-demographic characteristics and chronic illness

The mean age of the population was 56.2 years (SD 11.3) with 70.2% of the participants over 50 years and 92.2% were married. This study population consisted of 67% residing in urban areas, 64% were employed and 97% attained primary, secondary or tertiary levels of education indicative of high literacy levels (Table 3). In the assessment of history of chronic illness, seven participants (1.8%) had renal disease and were not on haemodialysis.

Table 3: Socio-demographic characteristics

Variable	Frequency (%)
Mean age in years (SD)	56.2 (11.3)
Category, n (%)	
30-39	35 (9.0)
40-49	80 (20.8)
50-59	90 (23.4)
60-70	180 (46.8)
Marital status	
Married	355 (92.2)
Single	18 (4.7)
Divorced	12 (3.1)
Residence	
Rural	54 (14.0)
Urban	259 (67.3)
Peri-urban	72 (18.7)
Occupation	
Employed	71 (18.4)
Self-employed	176 (45.7)
Retired	119 (30.9)
Unemployed	10 (2.6)
Student	3 (0.8)
Highest level of education	
None	13 (3.4)
Primary	93 (24.2)
Secondary	165 (42.9)
Post-secondary	68 (17.7)
University	46 (11.9)

Cardiovascular risk factors

The mean BMI of participants was 26.3 kg/m² (SD 4.6); 54.3% being either overweight or obese and 48.1% had an elevated waist-hip ratio (Figure 2). A history of past or current cigarette smoking was noted in 54.2% of the participants; current smokers were 19.7%, and 34.5% were former smokers. Hazardous alcohol intake was noted in 14% of respondents. Dyslipidaemia was reported in 65.2% of the respondents who had results available (Table 4).

Table 4: Cardiovascular risk factors

Variable	Frequency (%)
Mean BMI (SD)	26.3 (4.6)
Category, n (%)	
<18.5 underweight	14 (3.6)
18.5-24.9 normal	162 (42.1)
25-29.9 overweight	125 (32.5)
>30 obese	84 (21.8)

Waist-Hip ratio	
Mean (SD)	0.93 (0.12)
Categories, n (%)	
Elevated	185 (48.1)
Normal	200 (51.9)
Smoking status	
Current (currently smoking or stopped <5 years)	76 (19.7)
Former (stopped >5 years)	133 (34.5)
Never	176 (45.7)
Alcohol consumption	
Hazardous (AUDIT –C >4)	54 (14.0)
None	331 (86.0)
Dyslipidaemia (n=210)	
Yes	137 (65.2)
No	73 (34.8)

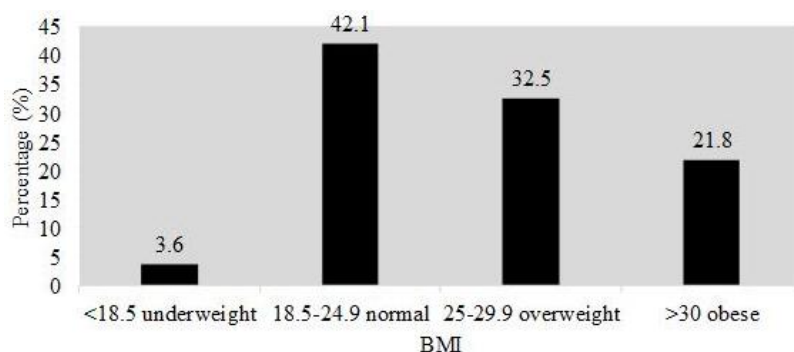


Figure 2: Body Mass Index distribution

History of hypertension and medication use

The median duration from diagnosis of hypertension was 5 years (IQR 3.0–10.0). A history of a first degree family member having hypertension was reported in 33.5% of participants. All participants were prescribed combinations of more than one class of antihypertensive medication. ACEi / ARB were the highest prescribed (75.8%) followed by calcium channel blockers (61.8%), b-blockers (33.5%) and only one in five participants were on thiazide diuretics (20%). Other medication commonly prescribed included aspirin (18.7%) and statins (16.9%) as shown in Table 5.

Table 5: Hypertension history, antihypertensive medication by class and other medication in use

Variable	Frequency (%)
Median duration of hypertension (IQR)	5.0 (3.0-10.0)
Family history of HTN	
Yes	129 (33.5)
No	256 (66.5)

Medications	
Antihypertensive[†]	
alpha blockers	18 (4.7)
ACE inhibitors/ARB	292 (75.8)
b-blockers	129 (33.5)
calcium channel blockers	238 (6)
diuretics thiazide	77 (20.0)
diuretic non-thiazide	53 (13.8)
Other drugs[†]	
warfarin	20 (5.2)
statin	65 (16.9)
aspirin	72 (18.7)
allopurinol	15 (3.9)
PPI	10 (2.6)
AED	30 (7.8)

[†]This represents use of more than one drug by study subjects

Prevalence of PAD in male hypertensive patients

One hundred and ninety-two participants (49.9%) had PAD in this study, 123 (31.9%) had mild, 17 (4.4%) had moderate and 52 (13.5%) had severe disease (Table 6).

Table 6: Prevalence of PAD in hypertension

Variable	Frequency (%)	95% CI
PAD		
Present (ABI < 0.9)	192 (49.9)	44.7-55.1%
Absent	193 (50.1)	
PAD Severity		
No PAD (ABI 1.0 – 1.2)	193 (50.1)	
Incompressible (Severe) (ABI >1.3)	52 (13.5)	
Mild (ABI 0.71 - 0.90)	123 (31.9)	
Moderate (ABI 0.41 – 0.70)	17 (4.4)	

Prevalence of erectile dysfunction (ED) in male hypertensive patients

The prevalence of ED was 94.5% (95% CI 92.2-96.6%). Mild ED (IIEF-5 score of 12-21) was diagnosed in 70.1%, moderate (IIEF-5 score of 8-11) in 21.9% and severe (IIEF-5 score of 5-7) in 9.1% as shown in Table 7.

Table 7: Prevalence of ED in hypertension

Variable	Frequency (%)	95% CI
ED		
Present (IIEF-5 <21)	364 (94.5)	92.2-96.6
Absent	21 (5.5)	
ED severity		
Mild (IIEF-5 12-21)	255 (70.1)	
Moderate (IIEF-5 8-11)	76 (21.9)	
Severe (IIEF-5 5-7)	33 (9.1)	

Factors associated with PAD in male hypertensive patients

Participants who were above 50 years had an OR 1.7 (95% CI 1.1-2.6), $p=0.021$ likelihood of having PAD. Past or current history of cigarette smoking was associated with increased PAD with OR 1.8 (95% CI 1.2-2.7), $p=0.005$.

Participants with an elevated waist-hip ratio had a statistically significant protective association with PAD (OR 0.4 $p < 0.001$). Hazardous alcohol consumption showed a protective association with PAD with OR 0.6 though not statistically significant ($p=0.08$).

On multivariate analysis the duration of diagnosis of hypertension and advancing age were not found to be significant contributors to PAD. On the other hand cigarette smoking was found to have a significant association with an adjusted OR of 1.9 ($p = 0.003$) as shown in Table 8.

Table 8: Factors associated with PAD

Variable n=192	PAD n (%)	No PAD n (%)	OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Age in years						
<50	47 (40.9)	68 (59.1)	1.0			
50+	145 (53.7)	125 (46.3)	1.7 (1.1-2.6)	0.021	1.4 (0.9-2.3)	0.126
Ever smoked						
Yes	118 (56.5)	91 (43.5)	1.8 (1.2-2.7)	0.005	1.9(1.2-2.9)	0.003
No	74 (42.0)	102 (58.0)	1.0			
Alcohol consumption in past 1 year						
Hazardous	21 (38.9)	33 (61.1)	0.6 (0.3-1.1)	0.082		
None	171 (51.7)	160 (48.3)	1.0			
Median duration of diagnosis of HTN (IQR)						
Duration	5.0 (3.0-10.0)	4.0 (2.0-10.0)	-	1.000	1.1 (0.7–1.7)	0.569
BMI						
18.5-24.9 normal	83 (51.2)	79 (48.2)	1.0			
<18.5 underweight	14 (100.0)	0	-	0.998		
25-29.9 overweight	54 (43.2)	71 (56.8)	0.7 (0.5-1.2)	0.177		
>30 obese	41 (48.8)	43 (51.2)	0.9 (0.5-1.5)	0.718		
Waist-hip ratio						
Abnormal	72 (38.9)	113 (61.1)	0.4 (0.3-0.6)	<0.001		
Normal	120 (60.0)	80 (40.0)	1.0			

Factors associated with ED in male hypertensive patients

This study did not find association between ED and the duration of hypertension from diagnosis, BMI and waist-hip ratio (Table 9). Any history of smoking history had an association with increased ED with an OR 1.3 although it was not statistically significant ($p > 0.528$). Hazardous alcohol consumption had a trend toward a protective association OR 0.7 but it was not statistically significant ($p > 0.515$).

Table 9: Factors associated with ED

Variable n=364	ED n (%)	No ED n (%)	OR (95% CI)	P value
Age in years				
<50	111 (96.5)	4 (3.5)	1.0	
50+	253 (93.7)	17 (6.3)	0.5 (0.2-1.6)	0.265
Ever smoked				
Yes	199 (95.2)	10 (4.8)	1.3 (0.6-3.2)	0.528
No	165 (93.8)	11 (6.2)	1.0	
Alcohol consumption in past 1 year				
Hazardous	50 (92.6)	4 (7.4)	0.7 (0.2-2.1)	0.515
None	314 (94.9)	17 (5.1)	1.0	
Median duration of HTN (IQR)	5.0 (3.0-10.0)	3.0 (3.0-15.0)	-	0.957
BMI				
18.5-24.9 normal	151 (93.2)	11 (6.8)	1.0	
<18.5 underweight	14 (100.0)	0	-	0.604
25-29.9 overweight/>30 obese	199 (95.2)	10 (4.8)	1.4 (0.6-3.5)	0.407
Waist-hip ratio				
Abnormal	178 (96.2)	7 (3.8)	1.0	
Normal	186 (93.0)	14 (7.0)	0.5 (0.2-1.3)	0.165

Concordance between ED and PAD diagnosis in male hypertensive patients

There was a significant agreement in diagnosis of ED and PAD in male hypertensive patients ($p < 0.001$). In 50.8% of the participants who had ED had PAD as shown in Table 10. The P value was calculated with McNemar's test with the continuity correction. The two-tailed P value was less than 0.001 and was statistically significant.

Table 10: ED and PAD concordance

	PAD	NO PAD	McNemar test P value<0.001
ED	185 (50.8)	179 (49.2)	364
NO ED	7 (33.3)	14 (66.7)	21
Totals	192	193	385

5.0 DISCUSSION

This hospital based cross-sectional study was conducted between January and July 2018 at the Kenyatta National Hospital, a national referral and teaching institution in Kenya. The study set out to establish the prevalence of peripheral arterial disease (PAD) by measuring ABI and the prevalence of erectile dysfunction (ED) by use of the validated IIEF-5 in male hypertensive patients.

The prevalence of PAD in male hypertensive patients was 49.9% comparable with African studies done in Nigeria (41.8%) (75) and sub-Saharan Africa (52%) (24). The high prevalence may be representative of several factors: from the role race has in early arterial stiffness (76) to PAD as a target organ damage that reflects missed opportunity for diagnosis, treatment, and control of its main risk factors such as hypertension as well as interventions such as lifestyle modifications including cigarette smoking cessation. Black ethnicity has been shown to increase the risk of PAD by two-fold independent of other risk factors such as hypertension or diabetes (76).

The prevalence of PAD in this study was higher than previous Kenyan studies done in other patient populations like in rheumatoid arthritis (25.5%) (26) and in chronic kidney disease (11.9%) (28). The difference in prevalence may reflect the differences in the patient population including the time to follow-up and aggressive treatment options that are instituted in the other comorbidities.

We found an elevated waist-hip ratio to have reduced risk of developing PAD (OR 0.4 (0.3-0.6) CI 95% P <0.001). This obesity paradox contrasts with other studies that did not find a protective association (34, 39) and thus requires further exploration and investigation into this association.

In our study the prevalence of PAD was higher in patients who had a history of cigarette smoking (56% OR 1.8 (1.2-2.7) P=0.005). These findings are comparable to a study done in Turkey that showed the prevalence of PAD was 50% in participants with a history of cigarette smoking (39). Another study showed that the odds of PAD increased 2.3-fold in current smokers and 2.6-fold among former smokers (38). The effect of cigarette smoking in hypertension is uncertain but has a strong association in PAD. For this reason and due to the high prevalence of cigarette smoking history in our study coupled with the association of increased PAD, it adds to existing data on justifying cessation of cigarette smoking as a modality of lifestyle modification in patients with PAD in hypertension.

On multivariate analysis, the duration of hypertension from diagnosis and age progression did not influence the odds of PAD as those who had PAD had a median of 5 year duration and those without PAD had a duration of 4 years which was not statistically significant. This finding is in keeping with international studies that did not find a significant relationship (16).

PAD is an established marker of atherosclerotic disease in other vascular beds the study findings may suggest a high at risk population for coronary artery disease. In our study we found that only a few patients were on statin and aspirin therapy largely due to other co morbid conditions. The high prevalence of PAD in hypertension in our study would justify the guidelines recommending earlier use of statins and aspirin in our population as a preventative measure in the treatment of PAD

The prevalence of erectile dysfunction (ED) was 94.5% in this population of hypertensive patients which was higher than a study done in Nigeria that reported a prevalence of 74.07% in newly diagnosed hypertensive patients and 86.20% in those not on treatment (53). In a USA study the prevalence of ED was 67-68% in hypertensive patients (56). In our study 9 in 10 hypertensive men on treatment were diagnosed with some form of ED showing a large proportion of unmet need. ED remains under-reported, under-diagnosed and under-treated largely due to under-recognition and the nature of the subject which may make physicians and patients uncomfortable to bring up. The high respondent rate in this study demonstrates the willingness of patients to speak about their sexual health and how it affects their well-being. This high prevalence should make an impact on changes in choices of medication and follow-up of patients with ED in hypertension.

The guidelines on treatment of hypertension call for use of CCB and thiazide diuretics as initial choice for treatment of patients in our ethnic black population. It is known that antihypertensive medication are contributing factors in the association between ED and hypertension (52). Most documented is the side effect of worsening ED with use of thiazide diuretics and beta blockers and the protective benefit of using ACEi and ARB (54). In our study the majority of patients were on ACEi or ARBs followed by CCBs yet the overall prevalence of ED was high, but the majority of respondents had mild ED (70%). The long term effect of these drug combinations on ED in our hypertensive male population will need to be assessed to ascertain the true nature of their interaction with progression and severity. Consideration into discontinuation of thiazide diuretics and beta blockers should be made in patients who achieve blood pressure control without them. Additionally the use of phosphodiesterase-5 inhibitors should be considered to achieve

improvement in erectile function.

In our study, ED was not associated with increasing age which is in contrast to other studies which may be due to the average age of the sample group being above the age of 50 years with lower numbers in the younger age brackets to adequately demonstrate age related progression comparison. Other studies have shown that the prevalence of ED increased with increasing age in the population; more than three-quarters of the patients who were 80 years or older had ED of some degree (59, 60).

Several studies have analysed the relationship between ED and PAD and have shown some degree of correlation. Our study showed a 50.8% agreement between ED and PAD in male hypertensive patients who had ED in keeping with data from USA that established men with any ED had significantly more PAD than men with no ED (19).

Our study findings demonstrate that one in two male hypertensive patients who have ED may have PAD. The underlying pathophysiology linking PAD and ED in hypertension is endothelial dysfunction due to similar atherosclerotic risk factors including reduced bioavailability of nitric oxide which impairs its antiatherogenic effects on inflammation, platelet aggregation, and smooth muscle proliferation (70). Once PAD is diagnosed it is a well-established indicator of increased cardiovascular morbidity and mortality. Consequently, in patients with established risk factors for PAD, guidelines from the AHA/ACC recommend screening ABI testing as PAD is recognized as a coronary risk equivalent. The goals of treatment after diagnosis of PAD should be similar to those in patients with established coronary artery disease (61). Studies have shown a reduction in the progression of PAD and cardiovascular events in patients who have aggressive treatment of hypertension and other co morbidities. For these reasons an early diagnosis of PAD may lead to better cardiovascular outcomes and can decrease lower extremity complications, such as critical limb ischemia and limb loss due to PAD. Therefore the findings of this study suggest that screening for ED using IIEF-5 on routine follow-up of hypertensive male patients may detect presence of PAD in men for further investigation of underlying coronary artery disease.

6.0 STUDY LIMITATIONS

Some individuals with asymptomatic PAD can have a normal resting ABI and may require further vascular testing. This could have led to under-diagnosis of PAD in this study.

As this study was done in a single tertiary level facility, the findings may not be generalizable to people of different socio-economic status and location due to tertiary facility level bias which may have led to referral of patients with more severe or advanced disease being enrolled into the study.

7.0 CONCLUSIONS

The prevalence of PAD in male hypertensive patients on antihypertensive medication in our population is higher than other populations studied and increases in those above the age of 50 years.

The majority of male hypertensive patients in our population had ED indicating the high burden that this condition has. The high response rate in filling in the questionnaire by patients and willingness to discuss their sexual health may point toward an unmet need from healthcare visits.

The study population had a significant prevalence of smoking history which was associated with an increase in the odds of PAD and requires more preventative measures being undertaken. There was also an increase magnitude of ED in those with a smoking history though not statistically significant.

The relatively younger age of the population studied (mean age of 56 years) that had a significant prevalence of ED and PAD coupled with the significant concordance between ED and PAD demonstrates a possibility that male patients in our population are at an increased risk for atherosclerotic disease.

The significant agreement between ED and PAD contributes to data to justify use of early screening for ED (using IIEF-5) to identify male patients for PAD screening by ABI for earlier diagnosis, adjustment of antihypertensive medication and lifestyle changes including cessation of cigarette smoking, to ensure better quality of life.

8.0 RECOMMENDATIONS

Male hypertensive patients should have screening for PAD and ED to detect early atherosclerotic changes as part of a cardiovascular risk assessment.

The high burden of ED is an unmet need that requires more training of primary care physicians in prevention, diagnosis, treatment and follow-up of patients.

Encourage the use of non-invasive questionnaire (IIEF-5) based screening of ED as an early detection tool for patients who require investigation of PAD.

A history of cigarette smoking was associated with an increased the odds of PAD in our study. These results contribute to existing data which can be used to increase public awareness on the adverse effects of cigarette smoking, with the aim of cessation and prevention of new generations from starting cigarette smoking.

Conduct this study on a larger multicentre population to determine the magnitude of PAD and ED and their associated factors in the general population.

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APPENDICES

APPENDIX I: PATIENTS' INFORMED CONSENT FORM

Title of the Study: "Peripheral arterial disease and erectile dysfunction prevalence in ambulant hypertensive males attending medical outpatient clinics at the Kenyatta National Hospital."

Introduction

My name is Dr. Malcolm Correia. I am a post-graduate student at the University of Nairobi. As a partial fulfilment for my master's degree in Internal Medicine, I am required to carry out research in the field of medicine. My research topic is "burden of peripheral arterial disease and erectile dysfunction in male hypertensive patients attending medical outpatient clinics in Kenyatta National Hospital."

Aim of the study

This study aims to generate data on the prevalence of peripheral arterial disease and erectile dysfunction in men with hypertension and to look at their association. Data generated will be used to sensitize doctors on the above issue with the hope that they will in future enquire, screen, and offer appropriate treatment to those affected. In addition, the results of the study will be used to offer recommendations which, if implemented, may lead to improved management and quality of life of male hypertensive patients with peripheral arterial disease and/or erectile dysfunction by altering therapeutic management.

Description of the Study

Once you agree to participate in the study, you shall be asked questions on your past medical history, perform a physical examination and asked to fill in a questionnaire on your sexual life. I shall measure blood pressure on your arm and leg to determine if you have abnormal circulation.

Voluntary participation

Your participation in this study is voluntary. Therefore you may decline to participate or withdraw from the study at any stage without any victimization. In the event that you decide not to participate, this will in not affect your treatment whatsoever. Kindly, do not write your name or indicate any other form of identification anywhere on the questionnaire. Please answer the questions as honestly as possible. The information given will be kept confidential and will only be used anonymously for making known research findings to other stakeholders.

Benefits

- 1. All the above examinations and tests shall be done at no cost to you.
- 2. Results will be communicated to you in person and into your medical file where necessary.
- 3. You shall be advised on whether intervention is necessary.

Risks

We do not expect any harm to you or your family as a result of your participation in this study.

Contacts

In case you have any questions about the study or regarding your participation, please contact the researcher, Malcolm Correia on cell phone no. 0734146366, supervisor Professor Ogola at the College of Health Sciences University of Nairobi or the KNH/ UON Ethics and Research Committee on (254-020) 2726300 extension 44355.

I.....have understood the information which has been given to me on the intention and purpose of this study titled ‘Burden of peripheral arterial disease and erectile dysfunction in male hypertensive patients attending outpatient clinics in Kenyatta National Hospital’, and have had my questions answered. I do understand that some of the questions touched on my private life and I have agreed to provide the information in confidence. I have also been assured that the information gathered from this study will in no way interfere negatively with my clinical care in this hospital or any other institution of medical care but, will be used to improve medical care for me and others alike.

I agree to take part in this study.

Participant’s signature Date/...../2017

Researcher’s signature..... Date...../...../2017

APPENDIX II A: STUDY PROFORMA

a. Study Number Hospital Number

b. Telephone Contact

A. SOCIODEMOGRAPHIC CHARACTERISTICS

Q.No	Questions	Response
Q1	Age as of last birthday	Age (years) _____
Q2	Marital status?	<input type="checkbox"/> Married <input type="checkbox"/> Single <input type="checkbox"/> Divorced <input type="checkbox"/> Cohabiting <input type="checkbox"/> Widowed <input type="checkbox"/> Others _____
Q3	Residence	<input type="checkbox"/> Rural <input type="checkbox"/> Urban <input type="checkbox"/> Peri-Urban
Q4	Highest level of education?	<input type="checkbox"/> Informal/None <input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> Post-Secondary <input type="checkbox"/> University <input type="checkbox"/> Others _____
Q5	Occupation	<input type="checkbox"/> Employed <input type="checkbox"/> Self-employed <input type="checkbox"/> Unemployed <input type="checkbox"/> Retired <input type="checkbox"/> Training/Student

B. HISTORY.

a. SMOKING HABITS

Q6	Smoking status:	<input type="checkbox"/> Current smoker or quit < 5 years <input type="checkbox"/> Former smoker quit \geq 5 years <input type="checkbox"/> Never-smoker
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b. ALCOHOL CONSUMPTION

Score _____

Q7	How often do you have a drink containing alcohol? (0-4)	<input type="checkbox"/> Never <input type="checkbox"/> Monthly or less <input type="checkbox"/> 2-4 times a month <input type="checkbox"/> 2-3 times a week <input type="checkbox"/> 4 or more times a week
Q8	How many drinks containing alcohol do you have on a typical day?(0-4)	<input type="checkbox"/> 1-2 <input type="checkbox"/> 3-4 <input type="checkbox"/> 5-6 <input type="checkbox"/> 7-9 <input type="checkbox"/> 10 or more
Q9	How often do you have six or more drinks on one occasion?(0-4)	<input type="checkbox"/> Never <input type="checkbox"/> Less than monthly <input type="checkbox"/> Monthly <input type="checkbox"/> Weekly <input type="checkbox"/> Daily or almost daily

C. CHRONIC ILLNESSES.

Q10	Hypertension	Duration (years).....
Q11	Family history of hypertension in first degree relative(Father,mother,siblings)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q12	Class of antihypertensive medications used in the last 3 months	<input type="checkbox"/> Alpha blockers <input type="checkbox"/> ACE inhibitors/ ARB <input type="checkbox"/> B blockers <input type="checkbox"/> Calcium channel blockers <input type="checkbox"/> Diuretics <input type="checkbox"/> Others.....
Q13	Kidney Disease	<input type="checkbox"/> Yes <input type="checkbox"/> No Duration (years).....
Q14	Dyslipidaemia Total Cholesterol (TC) ≥ 5.17 mmol/l, High Density Lipoprotein (HDL-C) ≤ 1.03 mmol/l, Low Density Lipoprotein ≥ 3.34 mmol/l, Triglyceride ≥ 1.69 mmol/l	1. TC _____ 2. HDL -C _____ 3. LDL-C _____ 4. TG _____ <input type="checkbox"/> Yes <input type="checkbox"/> No Duration (years).....
Q15	Liver Disease	<input type="checkbox"/> Yes <input type="checkbox"/> No

PAST MEDICAL HISTORY

Have you ever:

Q16	Been told by a doctor that you have coronary heart disease?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q17	Been treated for or diagnosed with angina (chest pain caused by inadequate blood flow to the heart muscles)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q18	Suffered from a heart attack?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q19	Had coronary bypass surgery?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q20	Coronary angioplasty (balloon angioplasty)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q21	Had a stroke?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Q22	Had a transient ischemic attack?	<input type="checkbox"/> Yes <input type="checkbox"/> No

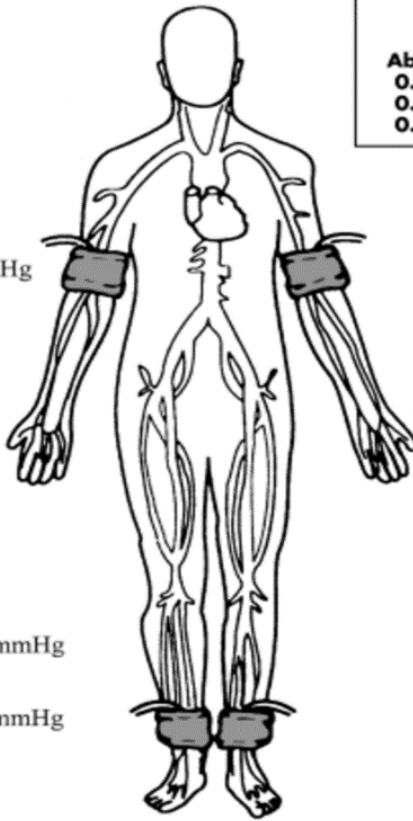
E. PHYSICAL EXAMINATION.

Height in meters.....	<input type="checkbox"/> <18.5 underweight, <input type="checkbox"/> 18.5-24.9 normal, <input type="checkbox"/> 25–29.9 overweight, <input type="checkbox"/> >30 obese.
Weight in kilograms	
BMI	
Waist circumference in centimetres.....	Significant 102 cm (40 inches)
Hip circumference in centimetre.....	Significant abnormal with a ratio of >0.9
Pulses:	Brachial: 1. <input type="checkbox"/> Present 2. Absent <input type="checkbox"/> Femoral: 1. <input type="checkbox"/> Present 2. Absent <input type="checkbox"/> Posterior tibial: 1. <input type="checkbox"/> Present 2. Absent <input type="checkbox"/> Dorsalispedis: 1. <input type="checkbox"/> Present 2. Absent <input type="checkbox"/>
Lower limb exam;	Gangrene : 1. <input type="checkbox"/> Yes 2. No <input type="checkbox"/> Ulcers : 1. <input type="checkbox"/> Yes 2. No <input type="checkbox"/> Amputation : 1. <input type="checkbox"/> Yes 2. No <input type="checkbox"/>

APPENDIX IIB: ANKLE BRANCHIAL INDEX

ABI WORKSHEET

Ankle-Brachial Index Interpretation
Above 0.90: Normal
0.71 - 0.90: Mild Obstruction
0.41 - 0.70: Moderate Obstruction
0.00 - 0.40: Severe Obstruction



Right Arm:
 Systolic Pressure mmHg

Left Arm:
 Systolic Pressure mmHg

Right Ankle:
Systolic Pressure
 Posterior Tibial (PT) mmHg
 Dorsalis Pedis (DP) mmHg

Left Ankle:
Systolic Pressure
 Posterior Tibial (PT) mmHg
 Dorsalis Pedis (DP) mmHg

Right ABI equals Ratio of:
Higher of the Right Ankle Pressures (PT or DP) mmHg = . *
Higher Arm Pressure (right or left arm) mmHg

Left ABI equals Ratio of:
Higher of the Left Ankle Pressures (PT or DP) mmHg = . *
Higher Arm Pressure (right or left arm) mmHg

* The lower of these numbers is the patient's overall ABI.
 Overall ABI (lower ABI) = _____

APPENDIX IIC: THE 5-ITEM INTERNATIONAL INDEX OF ERECTILE DYSFUNCTION (IIEF-5)

Purpose: To assess male patients' erectile dysfunction using the IIEF-5 questionnaire.

Please choose the appropriate column for each question about your sexual abilities over the past 4 weeks.

How do you rate your confidence that you can get and keep your erection?	Very Low	Low	Moderate	High	Very high
When you had erections with sexual stimulation, how often were your erections hard enough for penetration?	Never or almost never	A few times	Sometimes	Most times	Almost always or always
During sexual intercourse how often were you able to maintain your erection after you had penetrated (entered) your partner?	Never or almost never	A few times	Sometimes	Most times	Almost always or always
During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?	Never or almost never	A few times	Sometimes	Most times	Almost always or always
When you attempted sexual intercourse, how often was it satisfactory for you?	Never or almost never	A few times	Sometimes	Most times	Almost always or always

APPENDIX IV: SEHEMU YA MAELEZO NA UKUBALIANO NA UTAFITI HUU:

Kichwa cha utafiti: “Mzigo wa ugonjwa wa mifipa ya pembeni na ugonjwa wa shida ya kudindisha na uhusiano wazo baina ya wagonjwa wa kiume walio na ugonjwa wa shinikizo la damu wanaohudhuria matibabu katika kliniki za kutwa katika hospitali kuu ya Kenyatta”.

Utangulizi

Mimi ninaitwa Daktari Malcolm Correia. Mimi ni mtahiniwa katika Chuo Kikuu cha Nairobi. Ninafanya utafiti kuhusu mzigo wa ugonjwa wa mifipa ya pembeni na ugonjwa wa shida ya kudindisha na uhusiano wazo baina ya wagonjwa wa kiume walio na ugonjwa wa shinikizo la damu wanaohudhuria matibabu katika kliniki za kutwa katika hospitali kuu ya Kenyatta ili kutosheleza baadhi ya mahitaji ya shahada ya uzamili wa udaktari.

Lengo la utafiti

Utafiti huu unalenga kupata taarifa kuhusu mzigo wa ugonjwa wa mifipa ya pembeni na ugonjwa wa shida ya kudindisha baina ya wagonjwa wa kiume walio na ugonjwa wa shinikizo la damu na kubaini uhusiano uliopo baina ya magonjwa haya. Taarifa zitakazopatikana zitatumika kuelimisha madaktari kuhusiana na magonjwa haya hivyo kutoa nafasi bora ya kuwawezesha kutoa matibabu mwafaka kwa walioadhirika na magonjwa haya.

Utaratibu wa utafiti

Kama utachagua kushiriki katika utafiti huu, mhojaji atakuuliza mfululizo wa maswali kuhusu historia yako ya matibabu. Kisha, mhojaji atakuhitaji kulijaza dodoso kuhusiana na maisha yako ya mapenzi au ngono. Baada ya hayo, mtafiti mkuu atapima shinikizo la damu katika mkono na mguu wako ili kubaini iwapo una shida ya ugonjwa wa mifipa.

Kushiriki Kwako

Ushiriki katika utafiti huu ni wa hiari. Kwa hivyo, unaweza kusitisha kushiriki kwako wakati wowote endapo utaona ni vyema kufanya hivyo na hakutakuwa na athari zozote. Iwapo utaamua kutoshiriki, uamuzi huo hautaadhiri matibabu yako kwa njia yoyote.

Faida

1. Hakuna malipo yoyote utakayotozwa kwa vipimo vyote utakavyofanyiwa
2. Majibu ya utafiti huu yatawashirishwa kwako binafsi inapohitajika
3. Iwapo majibu ya utafiti itaonyesha kuwepo kwa magonjwa haya basi utapewa mawaidha kuhusu matibabu unayohitaji

Madhara

Hatutegemei ya kwamba utapata madhara yoyote kwa kushiriki kwako katika utafiti huu

Mawasiliano

Ikiwa utakuwa na maswali yoyote kuhusiana na utafiti huu au kushiriki kwako, wasiliana na mtafiti mkuu, Malcolm Correia kwa nambari 0734146366, msimamizi Profesa Ogola wa idara ya sayansi ya afya katika chuo kikuu cha Nairobi au kamitii ya ithini na utafiti (KNH/UON) kwa nambari ya simu (254-020) 2726300 ugani 44355.

Mimi.....nimeielewa habari nilizopewa kuhusiano na utafiti huu wenye mada “Mzigo wa ugonjwa wa mifipa ya pembeni na ugonjwa wa shida ya kudindisha na uhusiano wazo baina ya wagonjwa wa kiume walio na ugonjwa wa shinikizo la damu wanaohudhuria matibabu katika kliniki za kutwa katika hospitali kuu ya Kenyatta”. Maswali yangu yamejibiwa. Naelewa pia maswali mengine yatahusu maisha yangu ya ndani/siri na nimekubali kushiriki ikiwa usiri wa habari hizo utaangaziwa. Nakubali kushiriki katika utafiti huu. Pia nimeahidiwa kuwa habari nitakazotoa kwa ajili ya utafiti huu hazitaadhiri kwa namna yoyote matibabu yangu katika hospitali hii au hospitali nyingine yoyote bali zitatumika kuboresha matibabu yangu na wengenio.

Nakubali kushiriki katika utafiti huu

Saini ya mshiriki

Tarehe/...../2017

Saini ya mtafiti mkuu.....

Tarehe...../...../2017

APPENDIX VI: KISWAHILI VERSION OF THE INTERNATIONAL INDEX OF ERECTILE DYSFUNCTION (IIEF-5)

Madhumuni: Kutathmini hali ya ugonjwa wa shida ya kudindisha(matatizo ya kushiriki katika kitendo cha ngono) katika wagonjwa wa kiume tukiitumia dodoso/maswali ya IIEF-5

Tafadhali chagua safu/jibu inayoelezea kabisa hali ya uhusiano wako na uwezo wako katika tendo la ndoa/ngono katika kipindi cha wiki nne zilizopita

Je, imani yako katika uwezo wako wa kuanzisha kusimamisha (kudindisha) na kubaki umesimamisha uume wima ni wa kiasi gani?	Chini zaidi	Chini	Wastani	Juu	Juu zaidi
Je wakati ulipata Kudindisha/ kusimamisha uume wima, ni kwa mara ngapi ulifaulu kujamii/kumwingia mwenzi?	Sijaweza kamwe	Mara chache	Mara kwa mara	Mara nyingi	Wakati wote
Wakati wa tendo la ndoa ni mara ngapi uliweza kukaa kama umedindisha/kubaki umesimamisha uume wima baada ya kumwingia mwenzi?	Sijaweza Kamwe	Mara chache	Mara kwa mara	Mara nyingi	Wakati wote
Wakati wa tendo la ndoa, ni mara ngapi umeweza kudumisha hali ya uume kuwa wima kutoka kumwingia mwenzi hadi mwisho wa kitendo cha ndoa?	Kamwe	Mara chache	Mara kwa mara	Mara nyingi	Wakati wote
Wakati ulipojaribu kushiriki katika tendo la ndoa, ni kwa mara ngapi tendo hilo lilikuwa la kuridhisha kwako?	Kamwe	Mara chache	Mara kwa mara	Mara nyingi	Wakati wote