

Prevalence of the elevated urea and creatinine level among hypertensives: Perspective to raise the awareness about disease complications

Manal A. Fadl¹, Huda A. Fadlalmula² and Hisham AbdAllah Hussien³

¹Al Neelain University. Faculty of Science and Technology. Department of Biochemistry and Molecular Biology. Khartoum. Sudan. Email: manalfadl1@hotmail.com.

²Tropical Medicine Research Institute. National Centre for Research. Department of Epidemiology. Sudan.

³Industrial Research and Consultancy Center.

Abstract. An increasing prevalence of hypertension and mortality rate from hypertension complications especially the end stage kidney disease; urge the establishment of routine test for early detection of kidney disease. The aim of this study is to assess the blood urea and creatinine levels in routine visit of hypertensive individuals. Two hundred hypertension patients were enrolled in this study, the demographic and lifestyle data were collected by pre-designed questionnaire. Urea and creatinine were measured for 151 and 159 patient, respectively, using spectrophotometry kits method. Of the studied hypertensive patients, about two third are females (64.5%), 92% aged more than 40 years. 32.5% had diabetes, and 5.5% had kidney disease. No significant gender difference with regard to the development of complications such as diabetes, stroke, kidney disease and hyperlipidemia ($P = 0.7-1.0$). In less than ten years duration of hypertension; 32%, 11%, 5% and 49% of the patients develop diabetes, stroke, kidney disease and hyperlipidemia, respectively, which suggest an inadequate disease control. Of the behavioral risk factors salt; intake is significantly higher in males than in females ($P = 0.022$). 38.4% and 35.2% of the analyzed samples had an elevated urea and creatinine level, respectively. Twenty four of samples (=15%) had both abnormal urea and creatinine. Within less than five years duration of hypertension; 25% and 23% of the patients had abnormal urea and creatinine level, respectively. Insignificant association of neither the abnormal level of urea nor the creatinine with hypertension complications was reported ($P \geq 0.09$), however 36% and 35% of the hypertensive who were not previously diagnosed with kidney disease had an abnormal/ elevated urea/creatinine level, respectively. More than thirty five percent of the hypertensives had urea or creatinine measurements above normal levels. Such abnormal level was reported in less than five years duration of

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ORCID

0000-0001-9633-1805
Manal A. Fadl

0000-0002-6534-167X
Huda A. Fadlalmula

0000-0001-9183-8025
Hisham AbdAllah
Hussien

hypertension and were also observed in 36% and 35% of the hypertensive who were not previously diagnosed with kidney disease, which indicates an uncontrolled hypertension, lack of awareness of disease complications, thereby reflects the importance of the routine measurement of urea and creatinine.

Keywords: Hypertension; Urea; Creatinine; Hypertension complications.

Introduction

Hypertension is a global health issue with an increased magnitude from an estimated 975 million patients worldwide in 2000 to 1.39 billion in 2010 (Kearney et al., 2005; Mills et al., 2016). In Africa; the overall prevalence of hypertension was 55% in older people (Kazeet et al., 2017), while studies in Sub-Saharan Africa meta-analysis showed different prevalence in different age groups (Ataklte et al., 2015). Another study highlighted a wide range of prevalence of the disease (15.1%-51.1%) in 6 cities of sub-Saharan Africa (Gómez-Olivé et al., 2017).

In Sudan 9.9% of total population were registered as hypertensive cases at the Ministry of health in 2012, of which 15.9% live in rural areas (Balla et al., 2014). This percentage was increased in the subsequent years with increasing community based surveys, that showed that the prevalence of hypertension in the urban and rural community of the same State was 35.7% and 38.2%, respectively (Bushara et al., 2015, 2017), and it was 50% in one ethnic group also in the same State (Noor et al., 2016).

This increasing prevalence worldwide, in Africa and in Sudan clearly increased the morbidity rate, early age death and affect the productivity as well as economic growth. The estimated death caused by hypertension is half a million in Sub-Saharan Africa (Mensah et al., 2015). 10.4 million death and 218 million disability-adjusted life-years worldwide (GBD 2017 Risk Factor Collaborators, 2018).

The most obvious complications of hypertension are cardiovascular diseases, retinopathy and chronic kidney diseases (Biswas, 2003). WHO (2009) addressed that hypertension is the leading risk factor of cardiovascular diseases. With higher relative risk of death in low and middle income countries (Allen et al., 2017), In Sudan cardiovascular diseases accounts for 11.6% of deaths taking the higher percent of non-communicable disease death (WHO, 2015). Hypertension with diabetes are the main cause of chronic kidney disease in all high-income and low-income countries (Webster et al., 2017). In Sudan hypertension is the leading cause of end stage renal failure (Elsharif and Elsharif , 2011; Banaga et al., 2015. These complications are preventable by using strategies for prevention and control of hypertension (Patel et al., 2016).

Blood urea concentration test is a biochemical test indicates pre-renal kidney diseases, as urea produced mainly by the liver and excreted by the kidney. It is used as prognostic marker for surviving among myocardial infraction patients and acute coronary syndrome (Luria et al., 1976; Kirtane et al., 2005).

Moreover creatinine test is used specifically for the diagnosis of kidney disease associated with low excretion function of kidneys, hence creatinine is a byproduct of muscle catabolism and excreted by kidneys with limited or no reabsorption. Sudan hypertension guidelines recommend investigation of serum creatinine annually or in case of appearance of signs of target organ damage for good management of hypertension and its complications (Ministry of Health, 2012).

Study conducted in African with a symptomatic high blood pressure revealed a diminished renal function in 16.2% of the studied group and recommend routine serum

creatinine measurement for African patients with a symptomatic high blood pressure (Nishijima et al., 2010). It is necessary to rationale the need for routine testing to evaluate kidney function among Sudanese hypertension patients. The aim of this study was to assess blood urea and creatinine levels in hypertensive patients in their routine visit.

Method

Study design

A cross-sectional Hospital based study conducted in Khartoum State.

Inclusion criteria

All hypertensive patients during the study time attending cardiology outpatient clinics of Alrebat Teaching Hospital who agreed to participate were included.

Exclusion criteria

Pregnant women were excluded.

Demographic data

A total of 200 hypertensive patients were enrolled in this study. Demographic and risk factor data were obtained by filling pre-designed questionnaire.

Blood samples

3 mL of venous blood sample from hypertensives were collected in EDTA container, blood was centrifuged and plasma was aspirated into another container.

Urea and creatinine measurement

Using plasma part, urea and creatinine were measured using bio-system kits. After reading the absorption of samples and standard by UV-visible spectrophotometry, the calculation of concentration of samples were made according to instruction sheet provided by bio-system Company. Urea concentration was successfully measured in 151 cases, while creatinine concentration was successfully measured in 159 cases.

Ethical clearance

Ethical approval was obtained from the Ethical committee at the Faculty of Medical laboratory Science.

Informed consent

Informed consent was obtained from all participants after explaining the purpose of the study.

Statistical analysis

The demographic data, the urea and creatinine cross tabulated against demographic data, and comorbidities; all were analyzed using chi square test for SPSS version 21. P-value < 0.05 was taken as significant.

Result

Most of the participants (92%) are over 40 years old. 64.5% were females (Figure 1).

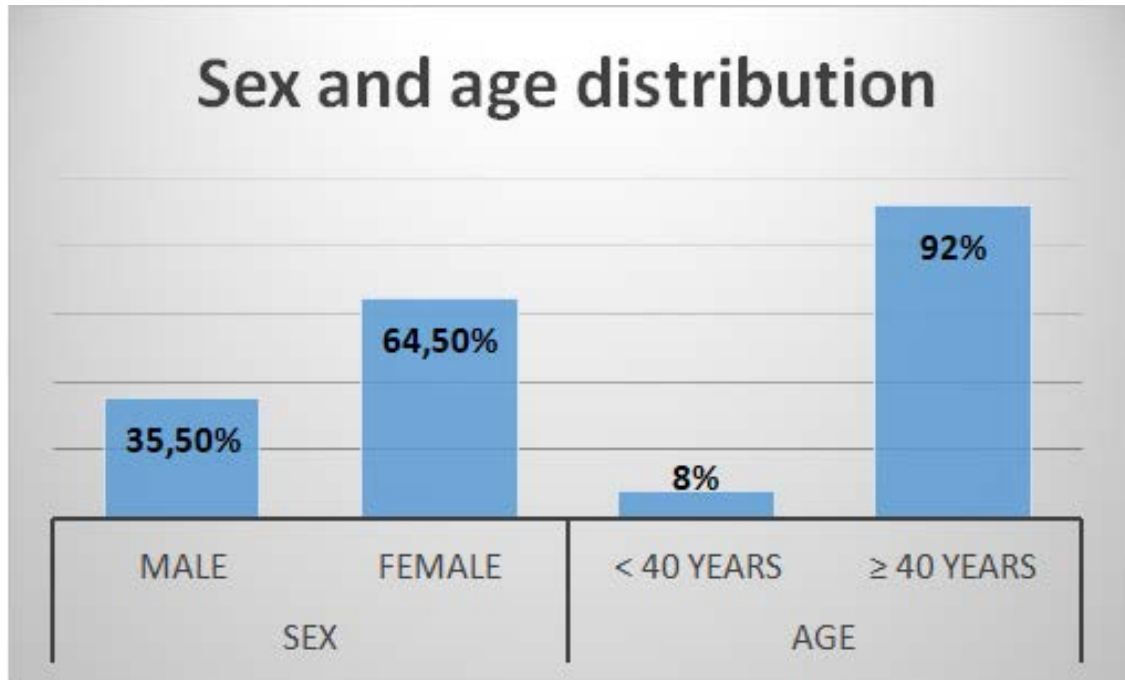


Figure 1. Shows the frequencies (%) of sex and age groups in the studied hypertensives.

The distribution of comorbidities (diabetes, stroke, kidney disease, and hyperlipidemia) was not differ significantly among different age groups ($p = 0.497, 0.863, 0.699$ and 0.537 , respectively) (Table 1), however, such complications were observed with 53%-64% frequencies among hypertensive aged 40-60 years old (Table 1), and were also reported among hypertensive in less than ten years duration of hypertension; 32%, 11%, 5% and 49%, respectively (Figure 2).

Table 1. Shows the distribution of hypertension comorbidities in different age groups.

| Age groups | Diabetes Miletus | | Stroke | | Kidney disease | | Hyperlipidemia | |
|------------|------------------|-------------|-------------|-------------|----------------|-------------|----------------|-------------|
| | yes | no | yes | no | yes | no | yes | no |
| 20-40 | 2 3.1% | 14 10.3% | 0 0% | 16 9% | 0 0% | 16 8.5% | 4 4.5% | 12 10.6% |
| 40-60 | 36 55.4% | 73 54.1% | 12 57.2% | 97 54.2% | 7 63.7% | 102 54% | 46 52.9% | 63 55.8% |
| > 60 | 27 41.5% | 48 35.6% | 9 42.9% | 66 36.9% | 4 36.4% | 71 37.6% | 37 42.5% | 38 33.8% |
| P value | 0.497 | | 0.863 | | 0.699 | | 0.537 | |

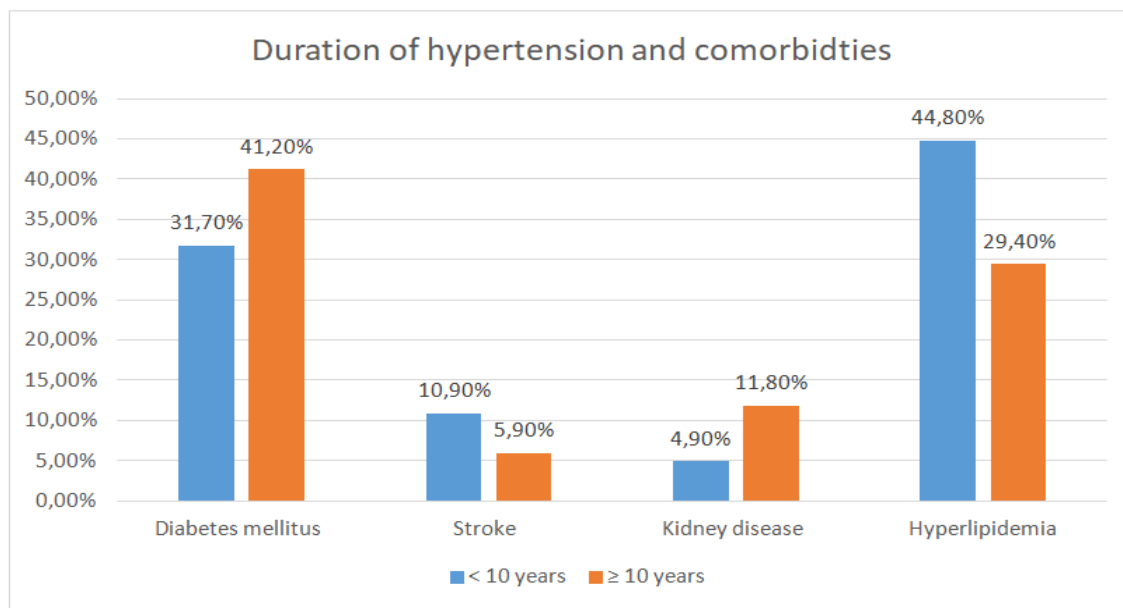


Figure 2. Shows the relation of hypertension complications with disease complications.

No significant gender difference with regard to the development of complications such as diabetes, stroke, and kidney disease and hyperlipidemia ($P > 0.7$) (Table 2).

Table 2. The distribution of comorbidities among hypertensive males and females.

| | Sex | | | | P value |
|-------------------|------------|-------------|------------|------------|---------|
| | Female=129 | | Male =71 | | |
| | Yes | No | Yes | No | |
| Diabetes mellitus | 41 (31.8%) | 88 (68.2%) | 24 (33.8%) | 47 (66.2%) | 0.87 |
| Stroke | 13 (10.1%) | 116 (89.9%) | 8 (11.3%) | 63 (88.7%) | 0.81 |
| Kidney disease | 8 (6.2%) | 121 (93.8%) | 3 (4.2%) | 68 (95.8%) | 0.75 |
| Hyperlipidemia | 56 (43.4%) | 73 (56.6%) | 31 (43.7%) | 40 (56.3%) | 1.0 |

Active smoking was not common 6/200 (3%) among cases both males and female. Sedentary life was not significantly differ in both sexes ($p = 0.920$). Salt intake showed a significant gender difference ($p = 0.022$). Sixty three percent of males take high to average salt, while 98% of the females take low to average salt (Table 3).

Table 2. Behavioral risk factors among hypertensive males and females.

| | | Sex | | P value |
|----------------|---------|--------------|------------|---------|
| | | Female = 129 | Male = 71 | |
| Smoking | Yes | 1 (0.8%) | 5 (7%) | 0.02 |
| | No | 128 (99.2%) | 66 (93.0%) | |
| Sedentary life | Yes | 70 (54.3%) | 38 (53.5%) | 0.92 |
| | No | 59 (45.7%) | 33 (46.5%) | |
| Salt intake | High | 2 (1.6%) | 6 (8.5%) | 0.022 |
| | Average | 90 (69.8%) | 39 (54.9%) | |
| | Low | 37 (28.6%) | 26 (36.6%) | |

The urea level was successfully measured for 151 patients and the creatinine for 159. 58 (38.4%) and 56 (35.2%) of the hypertensive had an elevated urea and creatinine levels, respectively (Table 4). Abnormal urea and creatinine showed a significant gender difference ($p \leq 0.032$) (Table 4). Within five years duration of hypertension; 25% and 23% of the patients had an abnormal urea and creatinine level, respectively (Table 4).

No association between the abnormal level of urea and creatinine and the development of diabetes, stroke, kidney disease or hyperlipidemia ($p \geq 0.09$) (Table 4). However, 36% and 35% who were not previously diagnosed with kidney disease had an abnormal urea/creatinine level, respectively (Table 4).

Table 4. Shows the urea and creatinine cross tabulation against sex, hypertension duration and commodities.

| | | Urea (n=151) | | P value | Creatinine (n=159) | | P value |
|--------------------------|----------------|--------------|------------|---------|--------------------|------------|---------|
| | | normal | abnormal | | normal | abnormal | |
| Sex | Female (n=129) | 71 (47.0%) | 33 (21.9%) | 0.018 | 76 (47.8%) | 32 (20.1%) | 0.03 |
| | Male (n=71) | 22 (14.5%) | 25 (16.6%) | | 27 (17.0%) | 24 (15.1%) | |
| Duration of hypertension | < 5 years | 62 (41.1%) | 38 (25.2%) | 1.0 | 69 (43.4%) | 36 (22.6%) | 0.73 |
| | ≥ 5 years | 31 (20.5%) | 20 (13.2%) | | 34 (21.4%) | 20 (12.6%) | |
| Diabetes mellitus | Yes | 28 (18.5%) | 24 (16%) | 0.16 | 39 (24.5%) | 15 (9.4%) | 0.17 |
| | No | 65 (43.0%) | 34 (22.5%) | | 64 (40.3%) | 41 (25.8%) | |
| Stroke | Yes | 13 (8.6%) | 7 (4.6%) | 0.81 | 16 (10.1%) | 4 (2.5%) | 0.14 |
| | No | 80 (53.0%) | 51 (33.8%) | | 87 (54.7%) | 52 (32.7%) | |
| Kidney disease | Yes | 3 (2%) | 4 (2.6%) | 0.43 | 7 (4.4%) | 1 (0.6%) | 0.26 |
| | No | 90 (59.6%) | 54 (35.8%) | | 96 (60.4%) | 55 (34.6%) | |
| Hyperlipidemia | Yes | 41 (27.2%) | 34 (22.5%) | 0.09 | 51 (32.1%) | 26 (16.4%) | 0.74 |
| | No | 52 (34.4%) | 24 (15.9%) | | 52 (32.7%) | 30 (18.8%) | |

An elevated level of both urea and creatinine were seen in 24 cases (15%), all of them above forty years old, half were males. Only 25% of them eating low salt diet, 70.8% live sedentary life. 29.2%, 8.2%, 0% and 58.3% had diabetes, stroke, kidney disease and hyperlipidemia, respectively.

Discussion

In Sudan, as in many developing countries; hypertension is considered as one of the public health problems. The increasing burden of hypertension is largely attributable not only to the behavioral factors; unhealthy diet, social stress, lack of regular exercise but also to the lack of awareness and in adequate control of the disease in both urban and rural areas (Sherif et al., 2008; Ataklte et al., 2015).

Given the fact that, in Sudan hypertension is the leading cause of end stage renal failure (Elsharif and Elsharif, 2011; Banaga et al., 2015); necessitate an increasing need to apply a predictive diagnostic measures, of which is the elevated level of urea and creatinine; an indicator of chronic renal disease, that is strongly related to inadequate treatment of hypertension thereby directly or indirectly lead to renal and cardio or cerebrovascular complications.

This cross-sectional study aimed to measure the urea and creatinine level in hypertensives.

The results showed more than one third of the examined cases had an elevated urea and creatinine concentrations (38.4% and 35.2%), respectively, of which 25% and 23% of hypertensives had abnormal urea and creatinine, respectively, within less than 5 years of hypertension duration. Which reflects an inadequate treatment or might be due to undiagnosed hypertension for long time (Yahalom et al., 2009). The significant gender relationship between abnormal urea or creatinine, might be due to the high catabolism rate and more male muscle mass compared to the females.

The analysis showed that the abnormal urea and creatinine level were not significantly associated with the reported kidney disease ($p = 0.43$, $p = 0.26$, respectively). This result is inconsistent with previous studies that showed that the elevated urea and creatinine levels might be an indicator for hypertensive nephrosclerosis as found by Chang et al. (2012) and also disagreed with study in Sudan which represent hypertension as the leading cause of end stage renal failure (Elsharif and Elsharif, 2011; Banaga et al., 2015). In addition, the elevated level of both urea and creatinine were reported in 15 % of the cases of which 29% and 8% developed diabetes and stroke, respectively, which is in agreement with Mohanty et al. (2015). Such situation urges an increased need to deep investigation for the risks and causes of the associated hypertension complications among hypertensive.

The analysis of the demographic data showed that the majority of the studied participants as all were from the outpatient clinics was of female gender, and this is consistent with widely known observation that male gender resistance to engagement in disease management (Muiesan et al., 2016; Sarganas and Neuhauser, 2016; Long et al., 2017), so they are less frequent in outpatient clinics, and found to be more in undiagnosed hypertension in population based studies (Chau et al., 2018; Ahmed et al., 2019).

Moreover, the appearance of complications and comorbidities with 53%-64% frequencies among hypertensive aged 40-60 years old which is the reproductive age, and the occurrence of such complications in short disease duration time (less than 10 ears); all these reflect poor understanding and management of the disease as found by Babiker et al. (2013). In addition, such complications are expected to affect the quality of life of hypertensive and their families.

The analysis showed that 3% of the hypertensives are smokers, 4% eating high salt diet and 54% not practicing exercise this agreed with Scisney-Matlock et al. (2009) and Steca et al. (2015) findings. Without changing lifestyle and behavior, the studied cases are suspected to develop more complications than those reported in this study (diabetes mellitus 32.5%, stroke 10.5%, kidney failure 5.5%, and hyperlipidemia 43.5%).

Conclusion

Hypertension complications (diabetes, stroke, kidney disease and hyperlipidemia) were reported with frequencies more than 53% in hypertensives aged 40-60 years. More than one third of the examined patients had an elevated urea and creatinine level which occur in less than five years duration of the disease. Moreover, such an elevated level was observed among patients not previously diagnosed with kidney disease. All these suggests either an ignorance, lack of awareness of disease complications, or improper diagnosis or insufficient disease controls or all these together. Such situation definitely adversely

affects the quality of life of hypertensives and poses a huge economic burden to both the patients and the healthcare providers.

With the adoption of westernized life and the socioeconomic stressful life of Sudanese people; hypertension risk factors might reach an epidemic level, expectedly results in an increasing burden of hypertension. This situation argues the implementation of the cost-effective public awareness and prevention, early detection programs and more reliable and specific biochemical tests should be adopted routinely to decrease the burden of the disease and to prevent disease complications.

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Conflict of interest

The authors declare that there is no conflict of interest.

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