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Prevalence of Traditional Risk Factors of Chronic Kidney Disease in an Agrarian Community in Edo State, Nigeria: Report of a Health Screening Survey

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ABSTRACT

Introduction: Chronic Kidney Disease **(**CKD) is a public health threat with negative impact on affected individuals, families and communities worldwide because of the prohibitive cost of care especially in those with endstage renal disease (ESRD). It is more cost-effective to identify risk factors of CKD with a view to mitigating them than to treat ESRD. The aim of the study was to determine the prevalence of risk factors of CKD in a semi-urban agrarian community in Edo State.

Materials and Methods*:* This was a cross-sectional study of adults who partook in a health screening exercise done in South Ibie Kingdom, an agrarian community in Edo State, Nigeria between February to May 2015 A structured interviewer- administered questionnaire was used to obtain data from respondents. History, clinical examination (including blood pressure and anthropometric measurement) and collection of urine sample for urinalysis, as well as blood for glucose and creatinine was undertaken. Data was analyzed with IBM SPSS statistics version 20.0.

Results: One hundred and sixty three respondents (70 males, 93 females) completed the study. The males were older with a mean age of 52.1 $\pm$ 18 yrs compared with 45.1 + 17.3 yrs for females (p= 0.02). Thirty three (20.2%) had a previous diagnosis of hypertension, 6.1 % diabetes, DM and 1.2 % kidney disease. A family history of hypertension, DM and kidney disease was found in 16.0%, 11.7% and 1.8% respectively. There was no difference in the proportion of these risk factors between males and females except for proteinuria which was more in females($p > 0.05$). The prevalence of elevated blood pressure, hyperglycemia and generalized obesity were 24.5%, 2.5% and 35.0% respectively. While 19.6% had proteinuria, 2.7% had hematuria. Thirty (18.4 %) participants had eGFR <90 mls/min. eGFR was significantly negatively correlated with age ($p < 0.001$), BMI ($p = 0.029$), SBP ($p < 0.001$) and DBP. ($p < 0.001$).

Conclusion: The prevalence of risk factors for CKD was high. To help reduce the scourge of CKD, there is need for regular screening of communities at the primary level for these risk factors followed by prompt intervention.

Keywords: chronic kidney disease, family history, hypertension, obesity, risk factors.

INTRODUCTION

The prevalence of chronic kidney disease (CKD), as the case with most other non-communicable diseases (NCDs), is on the rise globally. In 2017, the global prevalence of CKD was 9.1% resulting in 35.8 million disability-adjusted life years (DALYs).[1] This was higher than that for drug use, unsafe sanitation, low physical activity, second-hand smoke and several dietary risk factors. Several reports from

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sub-Saharan Africa, including Nigeria, suggest that the burden of CKD is high. [2] Ironically, these countries are among the disadvantaged ones with poor socio-economic and health indices, high rates of poverty, unemployment and poor access to health care. [3] Apart from infectious causes such as HIV and infectious glomerulonephritis, the rising prevalence of other NCDs such as hypertension, diabetes and obesity, which are traditional risk factors for CKD, have been alluded to as contributory to the increasing prevalence.[2]

CKD is a chronic, unrelenting disease eventually progressing to endstage renal disease (ESRD). However, early detection of the disease and identification and management of risk factors may help to retard the progression. In Nigeria, this is especially important bearing in mind that the cost of managing ESRD, in the form of dialysis or renal transplantation, is prohibitive. Up to 70 – 80 % of Nigerian patients can barely dialyze beyond three months.[4, 5] The implication is a huge financial, physical, psycho-social and economic drain on affected individuals, families and households. This is worsened by the absence of adequate health insurance coverage to prevent out-of-pocket expenditures. [6] Since it is more cost-effective to prevent CKD than to treat ESRD, it is important to put strategies in place in communities for early detection of the disease and associated risk factors that could accelerate its progression. This has led to the creation of health awareness initiatives such as the 'World Kidney Day' (WKD). The essence of the WKD is to draw global attention to the increasing global pandemic of kidney and associated cardiovascular disease and to seek to reduce the frequency and impact of kidney disease and associated health challenges. [7] It provides opportunity to screen targeted population for CKD and risk factors in many countries.

.The aim of the study was therefore to determine the risk factors of CKD in South-Ibie, a semi-urban agrarian community in Edo State, Nigeria as part of activities to mark the 2015 WKD with theme 'kidney health for all.'

MATERIALS AND METHODS

Study Design and Setting

This was a descriptive cross-sectional study carried out in South-Ibie Kingdom, an agrarian community located in Etsako West local government area (LGA) in Edo North Senatorial District of Edo state. The state is located in the south-south geographical zone of Nigeria. South Ibie Kingdom is one of the six clans of Etsako West LGA which has a total population of 198,975 persons [8] The residents of the community are predominantly subsistence farmers and traders in agricultural produce. The study was carried out between February to May 2015. The actual health screening exercise took place on the WKD which was celebrated on Thursday, 12th March 2015.

Sampling Method and Sample Size

A convenient sampling of all individuals who presented at the venue of the screening exercise during the WKD in March, 2015 was done. Persons less than 18 years, pregnant women and lactating mothers were excluded from the study.

The minimum sample size for this study was determined from the formula, $n = Z^2pq/d^2$ where n is minimum sample size. p is estimated prevalence of the disease (12.2% from a previous study, [9] which was determined from the highest frequency of risk factors) = 0.122. q= 1-p = 1 – 0.122 = 0.878. d = level of precision set at 0.05, Z=1.96 (standard normal deviate for 95% confidence interval).Thus, a minimum of 165 subjects would need to be recruited for the study to be adequately powered.

Study Procedure

All adults in the community were invited to a health screening exercise in the community town hall during the WKD in March 2015. Prior to the exercise, advocacy and health sensitization were done among the traditional, religious and key rulers of the community. They were asked to mobilize their subjects to attend the exercise. A town crier was also employed to send a message of invitation to the community in the local dialect a day prior to the event. There was also a preliminary 3 -day training of the health team which comprised of volunteer doctors, nurses, laboratory scientists, and medical records clerk, on the use of the questionnaire, the anthropometric and blood pressure measurements and other aspects of the study protocol.

The screening exercise was preceded by an interactive health talk on risk factors for kidney disease moderated by a member of the team and translated to their local dialect by an interpreter. The details

and protocols of the study were explained to them and informed consent obtained before continuing with the study. The protocol was divided into stages. In the first stage, two medical records officers obtained the bio-data of participants including age and sex as well as history of medical conditions such as individual and family history of kidney disease, hypertension and diabetes. This was followed by anthropometric measurements undertaken by two nurses. Weight was taken using a calibrated bathroom scale after respondent had removed shoes and other heavy clothing and measured to the nearest 0.1kg. Similarly, height was measured to the nearest 0.01m using a standiometer with the patient also without shoes or heavy garment and standing upright in such a way that the top part of the measuring scale was pressed against the head. The BMI was defined as the weight in kilograms divided by the square of the height in meters (kg/m^2). The body mass index (BMI) for each individual was determined by using World Health Organization (WHO) classification for obesity.[10]

Blood pressure was measured on the non-dominant arm with an automated OMRON digital sphygmomanometer using appropriate cuff size after respondent had rested for at least ten minutes. The first and fifth Krokoff sounds were chosen as the SBP and DBP respectively. The mean of two readings, five minutes apart, was determined.

Mid-stream urine was collected in plain bottles after providing adequate education to respondents on the appropriate procedure for collection. It was then examined with a Combi 9 dipstix (Medi-Test Combi 9; Macherey Negel, Germany) and particularly assessed for proteinuria and hematuria. Women who were menstruating were given a later date to provide their urine sample after completion of menses. Five milliliters (5mls) of venous blood was also taken from the respondents for estimation of serum creatinine. The sample were placed in lithium heparin bottles, slightly mixed with anticoagulants, immediately transported to a nearby chemical pathology laboratory and analyzed using the Modified Jaffe's method. Results was expressed in micromol/l. Capillary blood sample was obtained from a finger prick of the thumb on the non-dominant arm and Random blood glucose (RBG) measured using an Accuchek Glucometer with results expressed in mg/dl. RBG was used because it can be performed at any time of the day, does not require fasting, is convenient, simple and relatively cheap.

Study Instrument

An interviewer- based structured questionnaire adapted from the Nigerian Association of Nephrology (NAN) WKD proforma was used to obtain relevant information from respondents. The questionnaire was divided into various sections with section A containing questions on biodata, individual and family history of medical conditions such as kidney disease and risk factors, including hypertension and diabetes while section B contained data on clinical evaluation such as anthropometric measurement {weight, height, and body mass index (BMI)} as well as blood pressure evaluation. Section C contained reports of relevant investigations such as dipstick urinalysis, blood glucose and serum creatinine.

Operational Definitions

Hypertension was defined as the presence of elevated systolic blood pressure (SBP) and / or elevated diastolic blood pressure (DBP). Elevated SBP was defined as SBP > 140mmHg and elevated DBP as DBP > 90mmHg.[11]

An individual was considered to have hyperglycaemia if the plasma glucose level was 11.1 mmol/L or higher [12]

Obesity was defined as BMI $\geq$ 30kg/ m^2 while lesser values were considered as 'non-obese' [10]

Family history of hypertension, diabetes or CKD was defined as the presence of the respective conditions in first degree relatives

Dip stick proteinuria was defined as the presence of at least 1+ of protein in urine while hematuria was defined as the presence of at least 1+ blood in urine with a combi - 9 dipstix.

Ethical consideration

Ethical approval was obtained from the Ethical Research Committee of the Bayelsa State Ministry of Health as the study was intended to be a part of a large multicenter study titled 'Prevalence of hypertension, diabetes and obesity in south-south Nigeria involving Bayelsa, Rivers and Edo State. Assent and permission of the paramount ruler of the community was also obtained.

Participation in the study was voluntary and without coercion. A verbal informed consent was obtained from all participants after explanation of the nature of the study and the expected risks and benefits. The benefits include the opportunity to receive free health education and to get screened for relevant medical conditions while the risks include the pain associated with venipuncture and the efforts required in providing body samples for analysis. Anonymity was ensured through avoidance of use of respondents' names and other personal identifiable information. All information provided was kept with the strictest confidentiality.

Data Analysis

Data was entered, stored and analyzed using IBM SPSS version 20.0. Prevalence of CKD and risk factors was determined using frequency proportions. The student t-test was used to compare characteristics of males and female patients for continuous variables such as age, BMI and blood pressure. Cross- tabulation was done for categorical variables such as history of hypertension and diabetes with gender and analyzed with computation of Chi-square or Fisher's exact as appropriate. A p value < 0.05 was considered significant for all statistics. Data was presented in form of tables and graphs.

RESULTS

Out of the 164 participants screened, only one did not have complete data for most sections of the questionnaire. Thus, only data for 163 persons was used in analysis. The mean age of all respondents was 48.2± 18.4 yrs with a range of 18 – 92 yrs. The males accounted for 73(44.8%) of all respondents and were significantly older (with a mean age of 52.1 ± 18.0 yrs) than the females who had a mean age of 45.1 ± 17.3 yrs (p = 0.02). The mean BMI of respondents (28.41 ± 6.27) was in the overweight category. Although the females had higher BMI compared with the males who had higher weight, SBP, DBP, RBG and higher eGFR, statistical significance was not reached (p>0.05). (Table 1).

The prevalence of some risk factors of CKD is shown in table 2. More than half (54.6%) of the population was over 45 years of age. About one-fifth (20.2%) was previously diagnosed to be hypertensive while one quarter (24.5%) was discovered to have elevated blood pressure during the screening. Although more males (28.8%) had elevated BP compared with females (21.1%) proportion of those with a family history of hypertension was more with females (20.0% *vs* 11.0%), the observed differences were not statistically significant (p>0.05).

Ten (6.1%) of the respondents were previously diagnosed diabetics. Four {2(2.7%) males, 2(2.2%) females} were found to have elevated blood glucose during the exercise. Three (1.8%) of the participants (all males) had a previous diagnosis of kidney disease while two (1.2%) had a family history of CKD.

The prevalence of generalized obesity for all respondents was 35.0%. While 35(38.9%) females were obese, 22(30.1%) males had obesity with no

Table 1: Clinico-demographic variables of Respondents

Variable (n)	All	Male	Female	T	*P*
Age (yrs)(163)	48.22 + 18.36	52.08 + 18.02	45.09+17.28	2.85	0.02*
Weight (kg)(163)	75.45+ 15.53	76.86 + 15.07	74.31+ 15.89	1.05	0.297
BMI(kg/m^2)(163)	28.41 + 6.27	27.50 + 5.82	29.18 + 6.57	-1.66	0.098
RBG (mg/dl)(163)	115.38 +44.39	119.27 + 44.12	112.22+ 44.61	1.01	0.315
SBP (mmHg)(163)	129.58+22.84	131.81 +23.47	127.77 + 22.28	1.55	0.263
DBP(mmHg)(163)	81.28 + 14.86	82.03 +16.17	80.67 + 14.65	0.580	0.582
Serum Cr(µmol/l)(135)	73.35 +10.28	79.00 +10.01	68.62+ 7.87	6.77	< 0.001*
eGFR (mls/min)(135)	108.54 + 21.68	111.22 + 23.43	106.24 + 19.95	1.33	0.187

BMI = body mass index, Cr = creatinine, DBP = diastolic blood pressure, eGFR = estimated glomerular filtration rate, RBG = random blood glucose, SBP = systolic blood pressure, yrs = years

Table 2: Prevalence of risk factors of CKD

Variable	All	Male	Female	Chi-square	*P*
Age (yrs)					
<45	74(45.4)	30(41.1)	44(48.9)	0.988	0.320
>45	89(54.6)	43(58,9)	46(51.1)		
Known hypertensive (%)					
Yes	33(20.2)	15(20.5)	18(20.0)	0.007	0.931
No	130(79.8)	58(79.5)	72(80.0)		
Family Hx of HTN (%)					
Yes	26(16.0)	8(11.0)	18(20.0)	2.458	0.087
No	137(84.0)	65(89.0)	72(80.0)		
Elevated BP (%)					
Yes	40(24.5)	21(28.8)	19(21.1)	1.276	0.259
No	123(75.5)	52(71.2)	71(78.9)		
Known Diabetic (%)					
Yes	10(6.1)	6(8.2)	4(4.4)	0.997	0.345
No	153(93.1)	67(91.8)	86(95.6)		
Family Hx of DM (%)					
Yes	19(11.7)	8(11.0)	11(12.2)	0.062	0.803
No	144(88.3)	65(89.0)	79(87.8)		
Elevated RBG (%)					
Yes	4(2.5)	2(2.7)	2(2.2)	0.045	1.000
No	159(97.5)	71(97.3)	88(97.8)		
Known CKD (%)					
Yes	2(1.2)	2(2.7)	0(0.0)	2.496	0.199
No	161(98.8)	71(97.3)	90(100.0)		
Family Hx of CKD (%)					
Yes	3(1.8)	3(4.1)	0(0.0)	3.769	0.08
No	160(98.2)	70(95.9)	90(100.0)		
Presence of obesity (%)					
Yes	57(35.0)	22(30.1)	35(38.9)	1.358	0.254
No	106(65.0)	51(69.9)	55(61.1)		
Proteinuria (%)					
Yes	32(19.6)	9(12.3)	23(25.6)	4.469	0.035
No	131(80.4)	64(87.7)	67(74.4)		
Hematuria (%)					
Yes(6.7)	11(6.7)	2(2.7)	9(10.0)	3.376	0.113
No (9.3)	152(93.3)	71(97.3)	81(90.0)		

BP = blood pressure,CKD = chronic kidney disease, DM = diabetes mellitus,HTN = high blood pressure, Hx = history, RBG= random blood glucose,

statistically significant difference between them (p = 0.254). Proteinuria was found in 32 (19.6%) respondents with a higher proportion among females (25.5% females *vs* 12.3% males) and a statistically significant difference between them (p= 0.04). Hematuria on the other hand was seen in 2(2.7%) and 9(10.0%) of males and females respectively. There was no significant difference in this proportion (p= 0.11).

The eGFR categories among the respondents is shown in fig. 1.

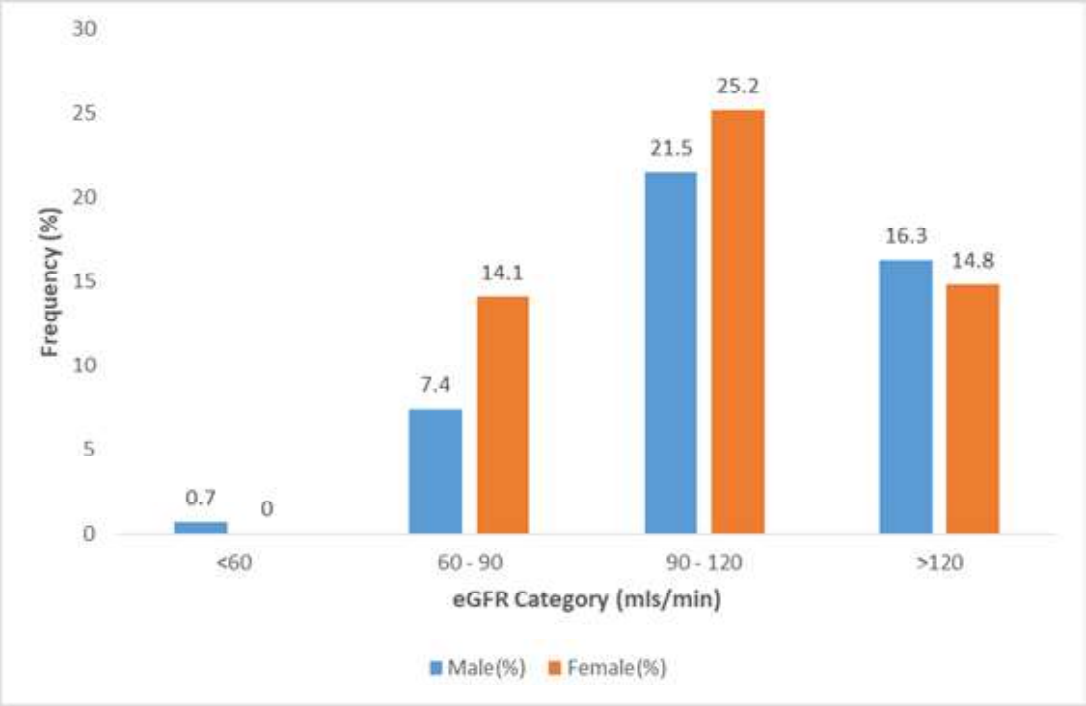

Fig 1: eGFR Categories among Male and Female Respondents

Table 3: Correlation of eGFR with clinico-demographic parameters

Variable	Correlation coefficient	p- value
Age (yrs)	-0.667	< 0.001*
BMI (kg/m2)	-0.189	0.029*
SBP (mmHg)	-0.347	< 0.001*
DBP (mmHg)	-0.296	< 0.001*
RBG	-0.152	0.078

*BMI = body mass index, SBP = systolic blood pressure, DBP = diastolic blood pressure, RBG = random blood glucose, * statistically significant*

A total of 30(22.2%) participants had eGFR <90 mls/min though only one participant (0.7%) had values < 60mls/min.

The correlation of eGFR with clinico-demographic variables is shown in table 3. eGFR was significantly negatively correlated with age (r = -0.666. p <0.001), BMI =0.819, p =0.029), SBP (-0.347, p <0.001) and DBP (-0.296, p < 0.001). There was also a negative correlation between eGFR and RBG (-0.152). However, the difference fell short of statistical significance (p = 0.08).

DISCUSSION

The rural sub-Saharan Africa is currently undergoing epidemiological transition from communicable to non-communicable diseases which may not be unrelated to the gradual adoption of unhealthy lifestyles [13] The CKD epidemic is driven globally by high prevalence of its risk factors which are often times not well controlled.[14] This study demonstrates a high prevalence of traditional risk factors of CKD in a sub-urban community in Edo, Nigeria. Non-modifiable factors assessed included the age of the population and presence of individual and family history of kidney disease as well as family history of hypertension and diabetes while modifiable factors were obesity, hypertension and diabetes. Apart from for DM, the risk factors were generally more prevalent in our study compared to a similar study by Okoye et al.[15] Also, while Wachuku found a higher prevalence of family history of hypertension, diabetes and CKD in their population,[9] we found a higher proportion of previously diagnosed hypertensives and diabetics. The prevalence of obesity was also higher

in our study. The mean age of our respondents was within the middle age bracket. In Nigeria and other countries in sub-Saharan Africa, CKD has been shown to predominantly affect young and middle aged individuals in their prime of life compared to those in more developed climes where the elderly are usually more affected [16]. Unfortunately, this is also when they are most economically productive, thereby resulting in reduction in number of man hours or loss of a country's workforce.

A family history of kidney disease has been shown to independently predict CKD in some population. [17, 18] This is not unexpected as evidence suggests that genetic factors may play a role in the epidemiology of CKD in Nigeria.[19] Nalado *et al* also identified 'a family history of hypertension' as an independent predictor of CKD in their study [17] This is of great concern considering that up to 16% of our study population had a family history of hypertension.

Up to 20% of respondents had a prior history of hypertension while almost a quarter was found with elevated blood pressure during the screening. This is consistent with recent reports of high prevalence of hypertension in the Nigerian population, inclusive of rural communities. [20 21] Since hypertension is a leading cause of CKD, the increasing rates of hypertension may parallel an increase in CKD prevalence in the nearest future. Diabetes, a leading cause of ESRD globally has also gained etiological prominence in Nigeria lately[22] partly attributable to its rising prevalence in the country. There has been a steep increase in national prevalence of DM from 2.2 % in 1997 to 5% as at 2013. [23, 24] We found a prevalence of 6.1% in our population. Rates ranging from 2% to 10% have been reported from previous studies in sub-urban populations [18, 21] Egbi *et al* reported a higher prevalence of 13.9:% in the same state where we carried out this study [25] The difference in rates may be due to differing methodology. Unlike the earlier study, this one did not incorporate individuals with prior diagnosis of DM in the diagnosis. Sabir et al found a lower prevalence of 4.3% in a younger sub-urban population in North-West Nigeria. [26] Diabetes has been reported to be predictive of CKD in our local settings.[27]

The prevalence of obesity in this study was also high. Up to 35% of the population had generalized obesity. The rate was even higher among women where more than 38% of them were found to be obese. Obesity is currently considered a pandemic affecting low, middle and high income countries [28] In Nigeria, its prevalence in rural communities have trailed behind rates in urban communities, but more recently, the gap appears to be closing [25] A recent systematic review and meta-analysis suggests that obesity may predict onset of CKD in the general population. [29]

Dipstick proteinuria was found in 19.6% of the participants. This was exactly the same rate reported from Abuja[17] similar to 19% obtained during a National Kidney Disease Awareness and Sensitization Program [30] but considerably higher than 4.3% reported from Enugu [20] though lower than 29.7% from Rivers state.[31] Proteinuria is not only a marker of kidney disease, but also facilitates progression of CKD, therefore heralding a worsening renal state. Its early detection could therefore provide an ample opportunity for quick intervention at the early stage to forestall or at least delay further renal damage. However, proteinuria is not specific and could follow vigorous exercise or high fever and can also result from common medical conditions such as urinary tract infection. It was therefore not surprising why the prevalence was more among females.

Hematuria, another marker of CKD, was present in 6.7% of our respondents. This is consistent with previous reports of prevalence rates of asymptomatic hematuria ranging from 0.19 – 16.1%. [32] The prevalence of hematuria was much higher among our female respondents though the difference was not statistically significant. This is also not unexpected as menstrual contamination and UTI could have contributed though steps were taken to minimize the effect of the former by ensuring that urine collection was done on a later date for women who were menstruating.

Most of the respondents had normal eGFR lying between 90 and 120 mls/min. (Fig.1) However, over one-fifth had eGFR less than 90mls/min. In this study, the eGFR was inversely correlated with age, BMI and blood pressure while the association with RBG was not significant. This is different from findings among civil servants in an urban community in Bayelsa State where there was no correlation of eGFR with BMI or blood pressure.[33] However, in line with our findings, there was a negative correlation with age but no correlation with blood glucose in that study.

In conclusion, the prevalence of risk factors of CKD in this agrarian population was high. These factors should be addressed at the primary level in order to curb the increasing burden of CKD. There is need for regular and continuous screening of communities for CKD and risk factors.

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CONFLICT OF INTEREST

No potential conflict of interest declared

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