International Journal of Bioinformatics and Biomedical Engineering
Vol. 4, No. 4, 2021, pp. 56-61
http://www.aiscience.org/journal/ijbbe
ISSN: 2381-7399 (Print); ISSN: 2381-7402 (Online)

Evaluation of Renal Diseases Risk Factors Among Hypertensive Patients in Zawia Region, Western Libya

Ashraf Mohamed Albakoush[1], Azab Elsayed Azab[2, *], Jbireal Masoud Jbireal[2], Abdulnaser Elshibani Mohammed Elharabi[3], Khalid Saied Osman Elnour[4]

[1]Department of Medical Laboratory, Faculty of Medical Technology, Sabratha University, Surman, Libya
[2]Department of Physiology, Faculty of Medicine, Sabratha University, Sabratha, Libya
[3]National Centre for Diseases Control, Faulty of Medicine, Tripoli University, Sabratha, Libya
[4]Department of Medical Laboratory, Faculty of Medical Technology, Zawia University, Zawia, Libya

Abstract

The aim of the study: This study was conducted to evaluate renal function in hypertensive patients using the estimated Glomerular Filtration Rate (eGFR). Methods: This study was conducted during August 2018, the subjects enrolled in this study divided into two groups (study group, control group). Study group, consists of 44 hypertensive patients (HTN). Control group was consists of 50 apparently healthy volunteers. A complete data record was obtained including name, age, gender, duration of hypertension, blood pressure (BP), weight, and height using standardized questionnaire. Members of both groups were within the same social class and dietary habit. Blood sample were obtained from both groups for measurement of creatinine, and urea. Venous blood was drawn in plain blood tube containing clot activator and immediately centrifuged at 3000 rpm for 5 minutes to obtain serum and immediately analyzed. The eGFR calculated using a software depend on the Modification of Diet in Renal Disease (MDRD) Study equation. Results: The present study showed that a significant increased in serum urea and creatinine levels in hypertensive patients when compared with healthy volunteers. On the other hand, the eGFR was significantly decreased in hypertensive patients as compared to healthy subjects. 31.8% of patients were in stage one, 40.9% in stage 2, and 15.9% in stage 3A, 4.5% in stage 3 B, and 6.8% in stage 5. The eGFR was decreased significantly with increasing of BMI and duration of hypertension. No correlation was observed between GFR and age, gender, and blood pressure. Conclusion: This study concluded that serum urea and creatinine were a significant increased and eGFR was significantly decreased and correlated with hypertension duration in hypertension patients. In some forms of CKD, HTN may be the earliest sign of kidney dysfunction and appropriate HTN management reduces kidney outcomes. Therefore, the hypertensive patient's should be advised to check the kidney functions periodically to avoid renal failure.

Keywords

Chronic Renal Failure, eGFR, Hypertension, Kidney Function

Received: November 15, 2018 / Accepted: December 13, 2018 / Published online: January 16, 2019

@ 2018 The Authors. Published by American Institute of Science. This Open Access article is under the CC BY license.
http://creativecommons.org/licenses/by/4.0/

1. Introduction

The lay view of renal function is that the kidneys remove waste liquids and potentially harmful end products of metabolism, such as urea, creatinine, uric acid, sulfates, and phosphates. While this is true, it should be emphasized that an equally important function is the conservation of substances that are essential to life. Such substances include

* Corresponding author
E-mail address: azabelsaied@yahoo.com (A. E. Azab)

water, sugar, amino acids, and electrolytes [1]. Kidney failure is defined as either a level of GFR to < 15mL/min/1.73 m², which is accompanied in most cases by signs and symptoms of uremia, or a need for initiation of kidney replacement therapy (dialysis or transplantation) for treatment for complications of decreased GFR, which would otherwise increase the risk of mortality and morbidity. Some patients may need dialysis or transplantation at GFR ≥ 15 mL/min/1.73 m² because of symptoms of uremia [2].

Diseases of the kidneys are amongst the most important causes of death and disability in many countries throughout the world [3]. Renal failure induces a slow and progressive decline of kidney function enhanced by various factors including infections, auto immune diseases, diabetes and other endocrine disorders, cancer, and toxic chemicals [4]. It is usually a result of complications arising from other serious medical conditions. Unlike acute renal failure, which happens quickly and suddenly, chronic renal failure occurs gradually - over a period of weeks, months, or years - as the kidneys slowly stop working, leading to an end-stage renal disease (ESRD) [5, 6]. High blood pressure is one of the leading causes of kidney failure. It may also damage the blood vessels in the kidney affecting the secretion of waste products. Waste may secrete extra cellular fluids and further raise the blood pressure eventually leading to ESRD [7].

Hypertension is a silent disease. It is insidious and relentless. The only reliable way to detect hypertension is to regularly check blood pressure. This should be done as part of a physical exam on every adult. If hypertension is not treated, there will be organ damage to kidneys, heart, and brain which is generally not reversible. Death in persons with hypertension most often occurs from heart failure, chronic renal failure, and stroke [8]. Glomerular filtration rate is the best estimate of number of functioning nephrons and functional renal mass. Accurate measurement of GFR is a time consuming and expensive, thus measurement of the blood levels of the elements regulated by the kidneys can become useful in evaluating kidney functions especially where there are limited resources. Literatures to evaluate the renal diseases risk factors among hypertensive patients are scarce especially in Western Libya. Therefore, the present work aimed to evaluate the renal diseases risk factors among hypertensive patients in Zawia Region, Western Libya.

2. Objectives

This study was conducted to evaluate the renal function in hypertensive patients in Zawia Region, Western Libya and explore whether eGFR change according to age, gender of patient, and duration hypertension.

3. Materials and Methods

3.1. Study Population

This study was conducted during August 2018, the subjects enrolled in this study divided into two groups (study group, control group). Study group, considered as patients group consists of 44 hypertensive patients. Control group was consists of 50 apparently healthy volunteers.

A complete data record was obtained including name, age, gender, duration of hypertension, blood pressure BP, weight, height, and family history of hypertension using standardized questionnaire. Members of both groups were within the same social class and dietary habit.

3.2. Blood Samples

Blood sample were obtained from both groups for measurement of creatinine, and urea. Venous blood was drawn in plain blood tube containing clot activator and immediately centrifuged at 3000 RPM for 5 minutes to obtain serum and immediately analyzed.

3.3. Body Mass Index (BMI)

$$BMI = \text{Weight (kg)}/ \text{Height (m)}^2$$

3.4. Laboratory Analysis

3.4.1. Determination of Serum Creatinine and Blood Urea

For serum urea and creatinine concentration, a spectrophotometer 4040 which manufactured by Robert Riele GmbH & Co KG in Berlin- Germany and reagent kits from Biomagreb Company (France) were used.

3.4.2. Estimated Glomerular Filtration Rate (eGFR)

Estimated Glomerular Filtration Rate calculated using a software depend on the Modification of Diet in Renal Disease (MDRD) Study equation.

$$eGFR\ (mL/min/1.73\ m^2) = 186 \times (S_{cr})^{-1.154} \times (Age)^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if African American})$$

3.5. Statistical Analysis

Statistical Package for Social Sciences (SPSS 21) software was used for statistical analyses. The mean, SD, and frequency distribution were used for descriptive statistics. Comparisons between variances were applied by Levene's test for Equality of Variances. Pearson correlation used for correlation between eGFR and other variables. A p-value of less than 0.01 & 0.05 were considered to represent a

statistically significant difference between groups.

4. Results

4.1. The Study Groups

Total of 44 patients (16 male, 28 female) were conducted in this study, they were diagnosed with hypertension previously in Zawia teaching hospital. On the other hand, a group of 50 healthy volunteers (29 male, 21 female) also studied as control group. The mean age of study group was 62.43±15.78 year (19 to 91year), as a mean age of control group was 36.12±13.91 year (20 to 77 year).

Table 1. Demographic and biochemical parameters of study and control groups.

Parameters \ Groups	Study group (n=44)	Control group (n=50)
Blood pressure (mm Hg)	151/86	113/79
Weight (kg)	78.3	75.2
Height (m)	1.62	1.6
BMI	29.3	25.1
Duration of HTN (year)	8.8	-
Serum urea (mg/dl)	40.7	27.8
Serum creatinine (mg/dl)	1.29	0.79
eGFR (ml/min)	75.5	127.2

4.2. Serum Urea, and Creatinine Levels and eGFR in Hypertensive Patients Compared with Control Group

Table 2 and figure 1 showed a significant increased in blood urea level in hypertensive patients compared with healthy volunteers (P= 0.001). Table 2 and figure 2 showed a significant increased in S. creatinine in hypertensive patients compared with healthy volunteers (P= 0.001). Table 2 and figure 3 showed a significant decreased (P=0.000) in eGFR in hypertensive patients compared to healthy subjects.

Table 2. Blood urea, creatinine levels and eGFR in hypertensive patients & control group.

Parameters \ Groups	Control group (n=50) Mean ±SD	Study group (n=44) Mean ±SD
Serum Urea (mg/dl)	27.76±0.16	40.73±39.54**
Serum Creatinine (mg/dl)	0.79±1.46	1.29±1.46**
eGFR (ml/min)	127.16±55.46	75.45±27.14**

**: Significant P < 0.01 as compared to controls

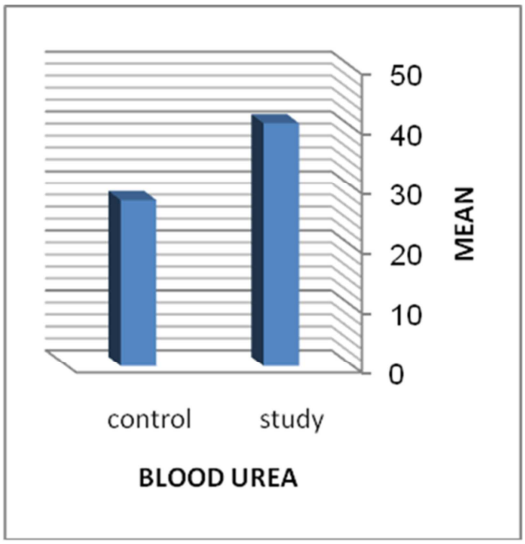

Figure 1. Comparison between serum urea in study & control groups.

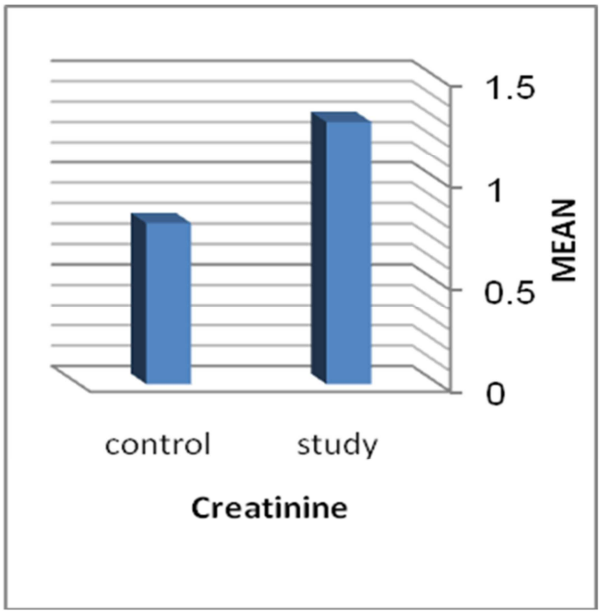

Figure 2. Comparison between serum creatinine in study & control groups.

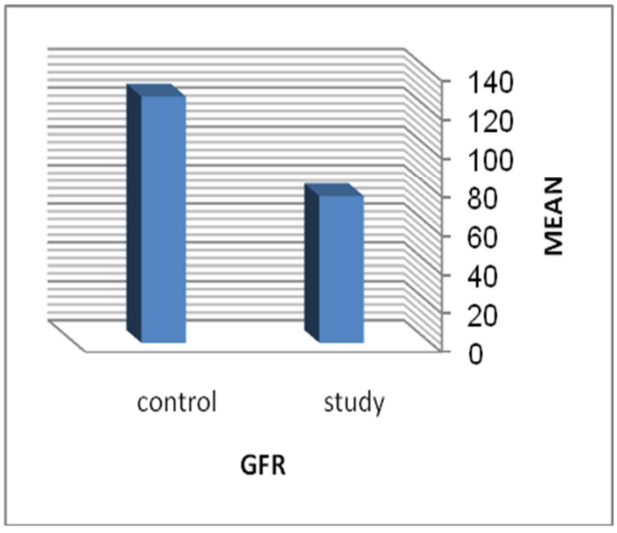

Figure 3. Comparison between eGFR in study & control.

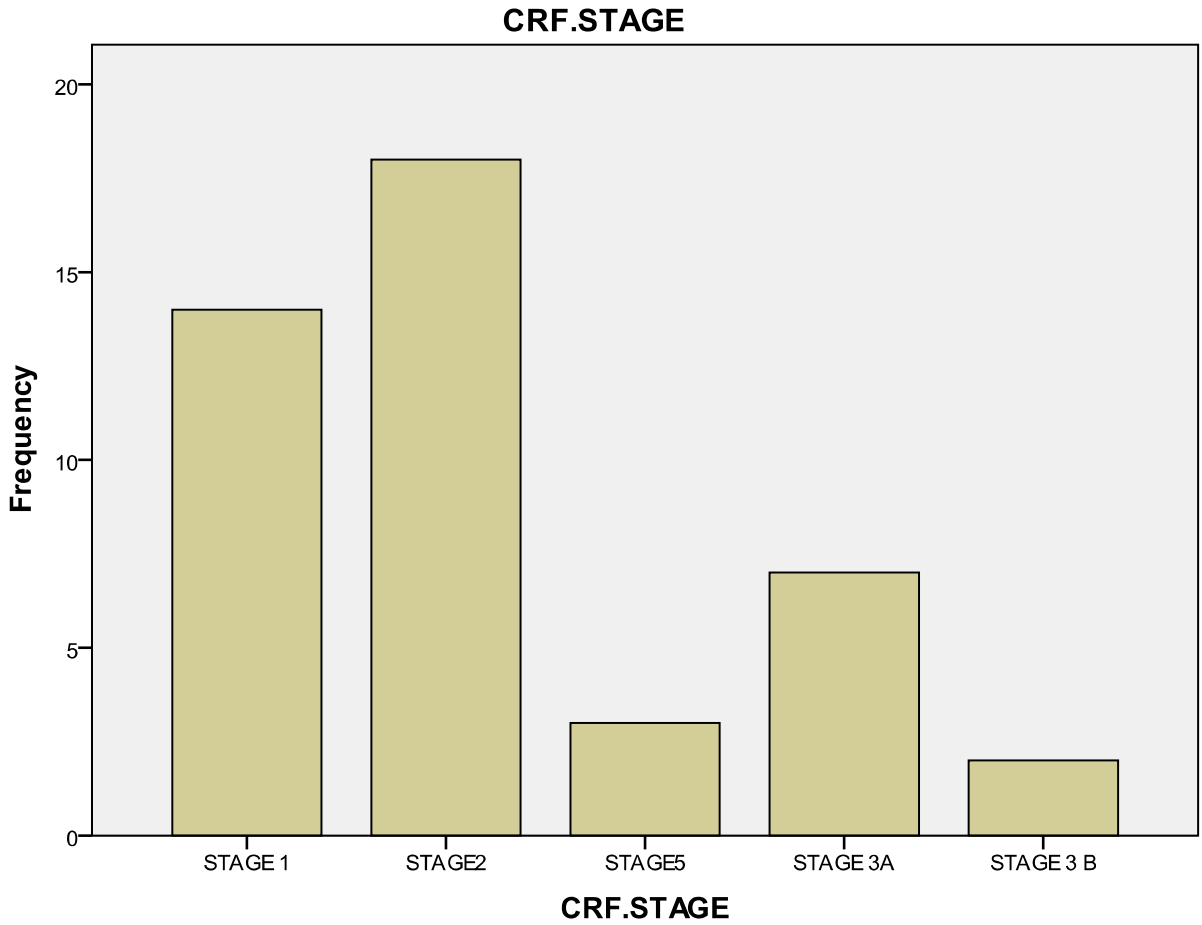

Figure 4. Stages of chronic failure in study group.

4.3. Chronic Renal Failure Stages in Control and Study Groups According to eGFR

Table 3. Frequency and percent in different stages of chronic renal failure.

Stages of chronic failure	Study group	
	Frequency	Percent (%)
Stage 1	14	31.8
Stage 2	18	40.9
Stage 5	3	6.8
Stage 3 A	7	15.9
Stage 3 B	2	4.5

31.8% of patients (n, 14) were classified as stage 1and 40.9% (n, 18) as stage 2 and 15.9% (n, 7) as stage 3A and 4.5% (n, 2) as stage 3 B and only 6.8% (n, 3) as stage 5. (Table 3 & Figure 4)

4.4. Variation of GFR according to Age, Gender, BMI, Duration of HTN, and Blood Pressure

The eGFR was decreased significantly with increasing of BMI and duration of hypertension as shown in table 4 (P= 0.021 & 0.000), respectively. No correlation was observed between GFR and age, gender, and blood pressure (Table 4).

Table 4. Variation of GFR according to age, gender, BMI, duration of HTN, and blood pressure.

Pearson correlation	Age	Gender	BMI	Duration of HTN	Diastolic. B. P	Systolic. B. P
Correlation of eGFR r	-0.29	0.22	0.34	-0.50	0.09	-0.03
P value	0.051	0.15	0.021*	0.000**	0.554	0.813

*: Correlation is significant at 0.05; **: Correlation is significant at 0.01

5. Discussion

High blood pressure is one of the leading causes of kidney failure. It may also damage the blood vessels in the kidney affecting the secretion of waste products [7]. If hypertension is not treated, there will be organ damage to kidneys, heart, and brain which is generally not reversible. Death in persons with hypertension most often occurs from heart failure, chronic renal failure, and stroke [8]. Glomerular filtration rate is the best estimate of number of functioning nephrons and functional renal mass. Accurate measurement of GFR is a time consuming and expensive, thus measurement of the

blood levels of the elements regulated by the kidneys can become useful in evaluating kidney functions especially where there are limited resources [9]

This study, showed significant increasing in blood urea and serum creatinine levels in hypertensive patients compared to healthy volunteers (P= 0.001). same as in study of Rakhee Yadav, which noted that the levels of blood urea, creatinine and uric acid were significantly higher in hypertensive patients as compared to healthy controls (p value <0.001) [10].

In present study, we found that the mean of eGFR calculated by MDRD was significantly decreased in hypertensive when compared with non hypertensive subjects (P=0.000). Previous study, noted that every 10–mm Hg increase in systolic and diastolic BPs associated with higher risk for decreased eGFR [11]. The relationship between blood pressure and the kidney is complex, and each may adversely affect the other [12]. The kidney is both a target and a cause of hypertension. Primary renal disease is the most common etiology of secondary hypertension. Mechanisms of kidney-related hypertension include a diminished capacity to excrete sodium, excessive renin secretion in relation to volume status, and sympathetic nervous system over activity [13]. This may be consistent with the hypothesis of a renal cause of essential hypertension, but can also be explained by renal damage caused by elevated BP [11].

In this study, 31.8% of patients were classified in stage 1 and 40.9% in stage 2 and 15.9% in stage 3A and 4.5% (n, 2) in stage 3 B and only 6.8% (n, 3) in stage 5. Classification depends on eGFR using MDRD and Prognosis of CKD by GFR and albuminuria categories: KDIGO 2012. In previous study, of 2,623 included participants, 912 (35%) and 280 (11%) had mildly and moderately/severely decreased eGFRs, respectively. Patients with moderately/severely decreased eGFRs had the greatest risk for death or major disability at 90 days (adjusted OR, 1.82; 95% CI, 1.28-2.61) [14].

The majority of patients with chronic kidney disease rarely progress beyond Stage 2. It is important for kidney disease to be diagnosed and treated early for serious damage to be prevented.

Patients with diabetes should have an annual test, which measures microalbuminuria (small amounts of protein) in urine. This test can detect early diabetic nephropathy (early kidney damage linked to diabetes) [15].

In correlation study, present study revealed a significant correlation between eGFR and the duration of hypertension, and BMI (P= 0.000 & 0.021) respectively. Previous study conducted in 2017 they found that the mean (standard deviation) GFR decline rate was 0.95 (2.23) mL/min/year. The percentage of persons with hypertension (systolic BP ≥ 140 mmHg, diastolic BP ≥ 90 mmHg or antihypertensive medication) increased from 42 to 52% between baseline and follow-up [16]. Turkey study, noted that the mean estimated (eGFR) was lower in obese children (122.7 ± 21.6 versus 129.4 ± 23.1, P < 0.001) [17]. Weight reduction to a BMI of <25 is beneficial [18].

In present study, no correlation was observed between eGFR and age, gender, and blood pressure levels. Adversely, previous study, noted that every 10–mm Hg increase in systolic and diastolic BPs associated with higher risk for decreased eGFR [11].

6. Conclusion

This study concluded that serum urea and creatinine were a significant increased and eGFR was significantly decreased and correlated with hypertension duration in hypertension patients. In some forms of CKD, HTN may be the earliest sign of kidney dysfunction and appropriate HTN management reduces both cardiovascular and kidney outcomes. Therefore, the hypertensive patient's should be advised to check the kidney functions periodically to avoid renal failure.

References

[1] Heins Valtin, James A Schafer. Renal function. 3rd edition. New York: Little Brown and Company; 1995.

[2] National Kidney Foundation. KDOQI Clinical Practice Gbrontc Kidney Disease; Evaluation, Classification and Stratification. Am J Kidney Dis. 2002; 39: S1-S266.

[3] Mascha V, Rashmi K, Priyadarshi SS, et al. Comparing age wise reference intervals for serum creatinine concentration in a "reality check" of the recommended cut-off. Indian J ClinBiochem. 2006; 21:90-94.

[4] Eduardo OC, Kaue A, Idania AA, et al. Influence of hemodialysis on the plasma concentration of adenosine deaminase in patients with chronic kidney disease. J Bras Patol Med Lab. 2015; 51:153-157.

[5] Al-Hisnawi RA, Salih H. A study of some biochemical changes in patients with chronic renal failure undergoing hemodialysis Int. J. Curr. Microbiol. App. Sci. 2014; 3(5): 581-586.

[6] Noor ul A, Raja Tahir M, JavaidAsad M, et al. evaluating urea and creatinine levels in chronic renal failure pre and post dialysis: A prospective study. J Cardiovasc Disease. 2014; 2: 1-5.

[7] Azra K. Estimation of blood urea (BUN) and serum creatinine level in patients of renal disorder. J Fundam Appl Sci. 2014; 4:199-202.

[8] Manrique C, Lastra G, Gardner M, Sowers JR. The renin angiotensin aldosterone system in hypertension: roles of insulin resistance and oxidative stress. Med Clin North Am. 2009; 93:569-582.

[9] Allhat Collaborative Research Group: Major Outcomes in high-risk hypertensive patients randomized to angiotensin converting enzyme inhibit or calcium channel blocker vs. diuretic: The antihypertensive and lipid-lowering treatment to prevent heart attack trial (ALLHAT). JAMA 2002; 288: 2981.

[10] Rakhee Yadav, Jai Prakash Bhartiya, Sunil Kumar Verma, Manoj Kumar Nandkeoliar. Evaluation of blood urea, creatinine and uric acid as markers of kidney functions in hypertensive patients: a prospective study. Indian J Basic Appl Med Res. 2014; 3(2): 682-689.

[11] Mathisen, U, Melsom, T, Ingebretsen, OC, Jenssen, TG, Njølstad, I, Solbu, MD, Toft, I, Eriksen, BO. The relationship between glomerular filtration rate measured as iohexol-clearance and ambulatory blood pressure in the general population: Pp.9.364. J Hypertension 2010; 28: e159 doi: 10.1097/01.hjh.0000378688.90439.cc.

[12] Garofalo C, Borrelli S, Pacilio M, Minutolo R, Chiodini P, De Nicola L, Conte G. Hypertension and prehypertension and prediction of development of decreased estimated GFR in the general population: a meta-analysis of cohort studies. American Journal of Kidney Diseases. 2016; 67(1): 89-97. DOI: https://doi.org/10.1053/j.ajkd.2015.08.027.

[13] Leoncini G, Sacchi G et al. Microalbuminuria is an integrated marker of subclinical organ damage in primary hypertension. J hypertension 2002; 16: 399.

[14] Zheng D, Sato S, Arima H, Heeley E, Delcourt C, Cao Y, Chalmers J, Anderson CS, Anderson CS, Chalmers J, Arima H. Estimated GFR and the effect of intensive blood pressure lowering after acute intracerebral hemorrhage. Amer J Kidney Diseases. 2016; 68(1): 94-102. https://doi.org/10.1053/j.ajkd.2016.01.020.

[15] Christian Nordqvist, CarissaStephen, RN, CCRN, CPN. Symtoms, causes, and treatment of chronic kidney disease. Med News today: 2017 Dec 13.

[16] Bjorn O. Eriksen, Vidar T. N. Stefansson, Trond G. Jenssen, Ulla D. Mathisen, Jørgen Schei, Marit D. Solbu, Tom Wilsgaard, and Toralf Melsom. Blood pressure and age-related GFR decline in the general population. BMC Nephrol. 2017; 18: 77. doi: 10.1186/s12882-017-0496-7.

[17] Duzova A, Yalçinkaya F, Baskin E, Bakkaloglu A, Soylemezoglu O. Prevalence of hypertension and decreased glomerular filtration rate in obese children: results of a population-based field study. Nephrol Dial Transplant. 2013; Suppl 4:iv166-171. doi: 10.1093/ndt/gft317.

[18] Sacks FM, Campos H. Dietary therapy in hypertension. N Engl J Med. 2010; 362: 2102-2112.