Prevalence of Impaired Renal Function among Prostate Enlarged Adult Attending General Hospitals in Benue State, Nigeria

Agada E. O.* Iwodi C. and Ogbonna I. O.

Department of Microbiology, College of Science, Joseph Sarwuan Tarka University, Makurdi, Benue State, Nigeria
* Corresponding author: eagada02@gmail.com

Abstract: Prevalence of impaired renal function among prostate enlarged adult attending General Hospitals in Benue State, Nigeria was carried out. Three hundred and sixty eight (368) samples of blood was collected from the 23 General Hospitals located in the Local Government Headquarters in Benue State, Nigeria. The plasma were used for the quantitative determination of prostate specific antigen (PSA), creatinine was quantitatively determined using MN CHIP 4 fully automated dry chemistry analyzer and Glomerular filtration rate (eGFR) was calculated using glomerular Filtration rate calculator software. The age of the patients were obtained from the case folders. The overall impaired renal function rate was 31.8 %. Patients within the ages 90-99 years had the highest impaired renal function (eGFR) of 80.0% and the least been those within the ages 40- 49 years with impaired renal function of (10.0%) The prevalence of impaired renal function with age groups was statistically significant ($\chi 2 = 51.50$, $p < 0.05$). Those patients with prostate specific antigen (PSA) level of > 100 ng/mL had the highest rate of renal impairment of (67.6%) and the least been those with prostate specific antigen (PSA) of 0-19 ng/ml that had impaired renal function rate of 15.9%. Prevalence of impaired renal function with prostate specific antigen (PSA) was statistically significant ($\chi 2 = 31.04$, $p < 0.05$).
Key word: Prostate specific antigen (PSA), impaired renal function (eGFR), creatinine, MN CHIP 4.

INTRODUCTION

Benign prostatic hyperplasia (BPH) with urinary retention can result in kidney dysfunction. Several risk factors might influence deterioration in kidney function (Zuhirman *et al.*, 2021). The urethra, which transports urine out of the body, runs through the prostate. When the prostate is enlarged due to BPH, it can compress the urethra and interfere with the flow of urine, the urine cannot pass from the body, resulting into renal failure. Renal failure, commonly known as kidney failure, occurs when the kidneys can no longer remove waste from the blood stream. Benign prostatic hyperplasia obstructs the flow of urine and this can contribute to renal failure. An enlarged prostate may cause difficulty urinating, a low flow, an inability to completely empty the bladder, urinating with blood (Oshodi *et al.*, 2015). Prostatitis and prostatic hyperplasia are diseases that commonly occurs during men's life span all over the world, and 35 – 50% of men have prostatitis at some time in their lives (Pyo *et al.*, 2016; Dybowski *et al.*, 2018). Benign prostatic hyperplasia symptom includes; urinating urgently, increased urinary frequency, the sensation that the bladder is always full, even after urinating and a weak urine stream. Other symptoms are straining while urinating, an inability to urinate, difficulty starting to urinate, dribbling urine, bloody urine, an infection of the urinary tract and a complete inability to urinate which requires a catheter (Oshodi *et al.*, 2015; Emeje *et al*., 2017).

Disorders of kidney function include acute kidney injury (AKI), chronic kidney disease (CKD) (Lee and Vincent, 2020). Serum urea and creatinine are most widely accepted parameters to assess chronic kidney disease (CKD) (Pandya *et al.*, 2016). Creatinine is less affected by diet and more suitable as an indicator of renal function (Josse, 2014).

Glomerular filtration rate (GFR) represents the flow of plasma from the glomerulus into Bowman's space over a specified period and is the chief measure of kidney function. The kidneys receive 20% to 25% of the cardiac output (about 1.0 to 1.1 liters per minute) with the blood entering individual glomerular tufts via the afferent arteriole and exiting through the efferent arteriole. Of this renal blood flow (RBF), only the plasma can cross the structures comprising the

glomerulus. So within the plasma, organic and inorganic solutes are freely filtered-meaning that they can be found in the ultra-filtrate (the fluid in Bowman's space) and plasma at the same concentrations. GFR is approximately 120 ml per min (180 L per day), (Fattah *et al.*, 2019; Asamar *et al*., 2019; Yavuz *et al.*, 2019). Therefore, the aim of this work is to determine the prevalence of impaired renal function among prostate enlarged adult attending General Hospitals in Benue State, Nigeria. So as to come out with appropriate findings and measures.

MATERIALS AND METHODS

Study Sample: Three hundred and sixty-eight (368) samples of blood were collected from the twenty-three (23) General Hospitals in Benue Statebetween 2nd January 2020 to 20th December 2022.The blood samples were analyzed for prostate specific antigen (PSA), urea and creatinine.

Sample size was determined using the formula (Charan and Biswa, 2013)

$$S = \frac{Z_1 - \alpha/2^2 - P(1-P)}{d^2}$$

Where;

S = sample size been sought

$Z_1 - \alpha/2^2$ = Standard normal variant (at 5% type 1 error p <0.05) it is 1.96

P= expected proportion in population based on previous study (62.2%) it 0.622

d = Absolute error or precision (0.05) Charan and Biswa (2013).

The sample size was 361, but for fair representation 368 were collected, that is 16 samples per General Hospital.

Quantitative determination of prostate specific antigen using finecre FIA meter: The blood samples were spun using bucket centrifuge at 3000 rpm for 10 minutes. The plasma were harvested and stored in cryio vials at -120^{0}C till time of analysis. The prostate specific antigen reagents were brought to room temperature alongside the sample. Using an automated pipette 75 µl of the plasma samples were pipetted into each of the buffer tube and gently inverted 10 times. Also automated pipette with a fresh pipette tip 75 µl of the samples plus buffer reagent mixture were pipetted into pre - labeled prostate specific antigen (PSA) cartridges coated with prostate specific antibody. Each of the cartridges were loaded into the Finecare ELISA analyzer and allowed to run for 15 minutes. The results were displayed on the screen as quantitative value in ng/ml with respective labels. The reference range was between 0-4 ng/ml.

Quantitative determination of creatinine using MN CHIP4 – Automated analyzer and estimation of glomerular filtration rate: Serum creatinine level was determined using MN CIHP 4 automated chemistry analyzer. The reagents and the cartridges were brought to room temperature. The analyzer was powered on and allowed for self-butting and calibration until it displayed ready. The bar code of the cartridge was scanned to get the kit details such as lot number, expiration date and kit constituents. The cartridge was placed on the analyzer cartridge holder and the blue film cover removed. The analyzer displayed a window for patient details. Exactly 100 µl of serum was added into the cartridge and press ok. The analyzers run automatically and print the results out which was documented within 15 minutes. The glomerular filtration rate (eGFR) was calculated using glomerular filtration rate calculation software. Normal glomerular filtration rate is approximately 120 mL/min/1.732 m^2 (Muhari-Stark and Burckart, 2018).

Statistical Analysis*:* Statistical analyses were done using the Statistical Package for Social Sciences (SPSS) version 17 (2008) currently known as Statistical Product and Service Solution. Pearson's Chi-square test was used to determine associations between variables at 95% confidence level with $p \leq 0.05$ being considered to be indicative of a statistically significant relationship between two or more variables.

RESULTS

Table 1: Distribution of Impaired Renal Function with Respect to Age

Age group (years)	No of serum examined	Impaired (egfr < 60 ml/min/1.73m^2) (%)	Non impaired (egfr > 60 ml/min/1.73m^2) (%)
40-49	60	6 (10)	54(90)
50-59	77	12(15.6)	65(71.4)
60-69	110	37(33.6)	73(66.4)
70-79	94	41(43.6)	53(56.4)
80-89	22	17 (77.3)	5(22.7)
90-99	5	4(80)	1(20)
Total	**368**	**117 (31.8)**	**251 (68.2)**

Key: eGFR= estimated Glomerular Filtration Rate 1.73m^2 =average surface area of an adult. mL/ min = milliliter /minute. $\chi 2$ (% Distribution of Impaired Renal Function vs Age) = 51.50, df =5, p = 0.001 (P < 0.05).

Table 2: Distribution of impaired renal function with respect to prostate specific antigen (PSA) level

Psa (ng/ml)	No of serum examined	Impaired (egfr < 60 ml/min/1.73m^2) (%)	Non- impaired (egfr > 60 ml/min/1.73m^2) (%)
0-19	182	29 (15.9)	153 (84.1)
20-39	53	11 (20.8)	42(79.2)
40-59	32	14 (43.8)	18 (56.3)
60-79	13	8 (61.5)	5 (38.5)
80-99	20	9 (45)	11 (55)
≥100	68	46 (67.6)	22 (32.4)
Total	368	117 (31.8)	251 (68.2)

Key: eGFR= estimated Glomerular Filtration Rate 1.73m^2 =average surface area of an adult. mL/ min = milliliter /minute. $\chi 2$ (% Distribution of Impaired Renal Function vsprostate Specific antigen (PSA) level) = 31.04, df =5, p = 0.001 (p < 0.05).

DISCUSSION

In this study, blood samples of 368 adult male patients with enlarged prostate were obtained and examined for prostate specific antigen quantitative using Enzyme- Link Immunosorbent Assay (ELISA) method; quantitative determination of creatinine was done using MNCHIP 4 (fully automated wet chemistry) analyzer. Patients within the ages of 90-99 years had the highest elevated impaired renal function rate of (80.0%). However, significant differences ($p < 0.05$) were observed in patients within the age range of 80-89 years with impaired renal function rate of (77.3%). This agrees with report of Li *et al*. (2012) that worked on 2,169 participants in a cross-sectional analysis and found out that kidney function was significantly associated with age, male, blood pressure and blood glucose. Those patients within the ages 70-79 years had impaired renal function of (43.6%), patients within the ages 60-69 years, 50-59 years and 40-49 years had percentage elevated impaired renal of (33.6 %, 15.6%, and 10.0%) respectively. The impairments increase with increase in age. There are significant differences ($p < 0.005$) in impaired renal function among the various age groups.

It is quite obvious from this study that those patients with higher impaired renal function markers are of the older group, this is in conformity with the work of Imai *et al*., (2009), that worked on the prevalence of chronic kidney disease in Japanese general population and found out that chronic kidney disease was a common condition in older people, the authors reported that nearly half of the population aged ≥80 years have an estimated glomerular filtration rate (eGFR) of ≤60 ml/min/1.73 m^2. Patients with

prostate specific antigen of ≥ 100 ng/ml had the highest rate of impaired renal function of 67.6 %, followed by those with the prostate specific antigen range of 60 – 79 ng/ml and 80 – 89 ng/ml with impairments rate of (61.6%) and (45.0%) respectively. Although, there is significant differences ($p < 0.05$) in the impairment rate between those patients with prostate specific antigen of 40 – 50 ng/ml and impaired renal function of (43.8%), patient with prostate specific antigen of 20 – 39 ng/ml had impaired renal function of 20.8% and the least been those patients with prostate specific antigen level of 0 – 19 ng/ml with renal impairment rate of 15.9%. The overall prevalence of impaired renal function is 31.8%, this is contrary to the reports of McConnell and Barry (1994) and Hill and Philpott (1993) who had an average of 13.6% and 7.7% respectively of renal failure.

CONCLUSION

The prevalence of impaired renal function in patients with benign prostatic hyperplasia was 31.8%. Patients within the ages of 90-99 years had the highest elevated impaired renal function rate of (80.0%). The impairments increase with increase in age and with increase in prostate specific antigen.

REFERENCES

Asamar, A., Cramon, P. K., Simonsen, L., Asmar, M., Sorensen, C.M., Madsbad, S., Moro, C., Hartmann, B., Jensen, B.L., Holst, J.J and Bülow, J. (2019). Extracellular fluid volume expansion uncovers a natriuretic action of GLP-1: A functional GLP-1-renal axis in man. *Journal of Clinical Endocrinology*, 104 (7): 2509 - 2519.

Charan, J. and Biswas, T. (2013). How to calculate sample size for different study designs in medical research. *Indian Journal of Psychological Medicine*, 35 (2): 121 - 126.

Dybowski, B.A., Zapala, P. and Bres-Niewada, E. (2018). Catheter-associated bacterial flora in patients with benign prostatic hyperplasia: Shift in antimicrobial susceptibility pattern. *BMC Infectious Diseases*, 18: 590-595.

Emeje IP, Ukibe NR, Onyenekwe CC and Nnamah NK (2017) Assessment of Serum Prostate Specific Antigen, Some Renal Indices and Uric Acid Levels in Subjects with Benign Prostatic Hyperplasia at Lokoja, Nigeria. J Bioanal Biomed 9: 256-262.

Fattah, H., Layton, A.andVallon, V. (2019). How do kidneys adapt to a deficit or loss in nephron number? *Physiology* (*Bethesda*). 34 (3): 189-197.

Hill AM and Philpott N (1993). Prevalence and outcome of renal impairment at prostatectomy. Br J Urol 71: 464-468.

Imai, E., Horio, M., Iseki, K., Yamagata, K., Watanabe, T., Hara, S., Ura, N., Kiyohara, Y., Hirakata, H., Moriyama, T., Ando, Y., Nitta, A., Inaguma, D., Narita, I., Iso, H., Wakai, K., Yasuda, A and Matsuo, S. (2009). Prevalence of chronic kidney disease (CKD) in the Japanese general population. *Clinical and Experimental Nephrology* 13: 621-630

Josse, H. S. (2014). Overview of urea and creatinine. *Laboratory Medicine*.45 (1): 19 - 20.

Li, G., Chen, Y., Hu, H., Liu, L., Hix, L., Wang, J., Shi, W and Yin, D. (2012). Association between age related decline of kidney function and plasma malondiadehyde. *Rejuvenation Research*, 15 (3):257 - 264.

McConnell JD and Barry MJ (1994). Benign prostatic hyperplasia: diagnosis and treatment. Agency for Health Care Policy and Research. Clin Pract Guidel Quick Ref Guide Clin. pp: 1-17.

Muhari-Stark, E and Burcart, G.J (2018). Glomerular filteration rate estimation formulas for peadeatric and neonatal Use. *Journal of Pediatric Pharmacology Therapeutics*. 23 (6): 424-431.

Oshodi, A. J., Nwabuisi, C., Popoola, A. A., Eduungbola, C. D., Agbede. O. O., Akanbi II, A. A., Fadeyi, A.andRaheem, R.A. (2015). Bacterial uropathogen among benign prostatic hyperplasia patients at a tertiary hospital in Nigeria. *Open Journal of Medical Microbiology*, 6:22 - 27.

Pandya, D., Ngarajappa, A. K. and Ravis, K.S.(2016). Assessment and correlation of urea and creatinine levels in saliva and serum of patients with chronic kidney disease, Diabetes and hypertension- A research study. *Journal of Clinical and Diagnostic Research*, 10 (10): 58 -62.

Pyo, H. K., Lee, W. Y., Lee, H. S., Xin, F. C., Shin, H. J and Shin, H. E. (2016). Preventive effect of resveratrol – Enriched extract of peanut sprout on bacteria and estradiol induced prostatitis in mice. *Natural Product Communication*, 12 (1): 73 -78.

Yavuz, Y.C., Altınkaynak, K., Sevinc, C., OzbekSebin, S., Baydar, I.(2019). The cartonectin levels at different stages of chronic kidney disease and related factors. *Renal Failure*. 41 (1): 42 - 46.

Zuhirman, Z., Herman, R. and Nafisa, A. Z. (2021). Associations between kidney dysfunction and risk factors in patients with tans urethral resection of the prostate. *Research and Reports in Urology*, 13: 665 - 672.