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RESEARCH ARTICLE

Serum Creatinine and Estimated Glomerular Filtration Rate (eGFR) In Elderly Male Persons

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ABSTRACT: Prevalence of chronic kidney diseases increases with age. This study was done to observe some aspects of renal function status in elderly male in comparison to younger male. This analytical type of cross-sectional study was carried out in the Department of Physiology, Mymensingh Medical College, Mymensingh, Bangladesh from January 2019 to December 2019. A total number of 140 male subjects were included in this study. Among them seventy (70) younger males were taken as control group (Group I), and seventy (70) elderly males were taken as study group (Group II). Serum creatinine was measured by kinetic colorimetric method and estimated glomerular filtration rate (eGFR) by using Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation. Data were expressed as mean (±SD) and statistical significance of difference among the group was calculated by unpaired student's t-test. Pearson's correlation coefficient test was done to find the correlation of eGFR with age. In this study we found that eGFR of elderly male was significantly decreased than younger male. serum creatinine was slightly higher in elderly male persons in comparison to younger male. Although the magnitude of correlation differed, eGFR was negatively correlated with age of the subjects. Based on the study carried out it can be concluded that due to the aging process geriatric populations are more prone to the development of kidney diseases than younger individuals.

Keywords: Elderly Male, Serum Creatinine, Estimated Glomerular Filtration Rate (eGFR).

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INTRODUCTION

Aging, an inevitable and extremely complex, multifactorial process, is characterized by the progressive degeneration of organ systems and tissues. It is largely determined by genetics, and influenced by a wide range of environmental factors, such as diet, exercise, exposure to microorganisms, pollutants, and ionizing radiation.[1] The United Nations uses 60 years to refer to older people and taken to be elderly segment of the population of a country.[2] According to the long questionnaire survey, census 2011, the percentage of elderly in Bangladesh is 7.7 percent.[3] The statistical data of Bangladesh represent the number of aged populations has increased from 1.38 million to 7.59 million from the year of 1974-2001 and projected figure difference from 2000 to 2025 will be 10.37 million.[4] This should be seen as an emerging challenge as the elderly will have special needs and require different care-giving services.

Physiological and pathological changes impair the ability of the kidney to withstand and recover from injury, contributing to high susceptibility of the aged population to AKI (Acute kidney injury) and their increased propensity to develop subsequent progressive CKD (chronic kidney disease).[5] Based on Medicare (age> 65 years) claims data for 2011 prevalent US population, CKD was noted to be about 10% in older in contrast to 1.5% of the younger employed population suggesting that the elderly carried the overall burden of CKD.[6] Huda *et al.*, reported that the prevalence of CKD was higher among elderly people aged more than 40 years (16.5%) than their counterparts whose age was between 25 and 40 years (10.7%).[7] Bambui study, conducted in a small city in southeast Brazil showed that 5.1% of the residents aged > 60 years had an increased serum creatinine value.[8] Zhang et al, showed that 4.6% of normotensive elderly people had higher serum creatinine level than normal.[9]

In a study of primary care practices across Britain, Roderick *et al.*, conducted a multidimensional assessment of adults 75 years and older of whom more than half had an eGFR of less than 60 ml/min/1.73m.[2, 10] A cross-sectional study in Greek among participants aged 65 years old and over found eGFR level between 60 ml/min and 89ml/min. This study also reported that age was negatively associated with the value of eGFR.[11] Impaired kidney function is

highly prevalent in elderly and is a risk factor for cardiovascular disease, adverse health outcome and death. Because kidney function is a major determinant of health in the elderly, it is important to understand the expected rate of change in kidney function.[12]

METHODS

The present study was a cross-sectional analytical study. It was conducted in Department of physiology, Mymensingh Medical College, Mymensingh from January 2019 to December 2019. Ethical permission was taken from the Institutional Review Committee of Mymensingh Medical College. The subjects were obtained from the Department of Medicine, Mymensingh Medical College & Hospital and from the locality of Mymensingh. The subjects were selected by purposive sampling. After proper counseling, written informed consent was taken. A total number of 140 male subjects were included in this study. Among them seventy (70) younger males were taken as control group (Group I), and seventy (70) elderly males were taken as study group (Group II). Serum creatinine was measured by kinetic colorimetric method and estimated glomerular filtration rate (eGFR) by using Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation based on serum creatinine. Data were expressed as mean (±SD) and statistical significance of difference among the groups was calculated by unpaired student's t-test. Pearson's correlation coefficient test was done to correlate the relationship of eGFR with age of the subjects. Statistical analysis was done by using Statistical package for social science (SPSS) for windows version-21. P value <0.05 was considered as significant.

RESULTS

In this study the mean age of control group (Group I) was 31.90±6.35 years & the mean age of study group (Group II) was 66.84±5.54 years. The mean (±SD) of serum Creatinine of control group (younger male) and study group (elderly male) were 0.81±0.10 mg/dl & 0.84±0.16 mg/dl respectively. In the study group, serum Creatinine was slightly increased in comparison to the control group. The mean (±SD) of eGFR level of control group (younger male) and study group (elderly male) were 117.21±9.63 mg/dl & 89.9±11.43 mg/dl respectively. In study group serum eGFR level was decreased in comparison to control group. Result is highly significant (p<0.001). eGFR (r= -0.830) was negatively correlated with age and this relationship was statistically significant. (The results are shown in figure 1, 2 and 3).

Table 1: Comparison of Serum Creatinine and eGFR Between Two Groups

Parameters	Group I (n=70) Mean±SD	Group II (n=70) Mean±SD	P value
S. Creatinine (mg/dl)	0.81±0.10	0.84±0.16	0.186
eGFR (ml/min/1.73m2)	117.21±9.6	89.9±11.43	0.00**

n = Total number of subjects in each group, Data are expressed as mean±SD. Statistical analysis were done by unpaired student's 't' test. *= significant at 0.05 level. ** = Significant at p < 0.001.

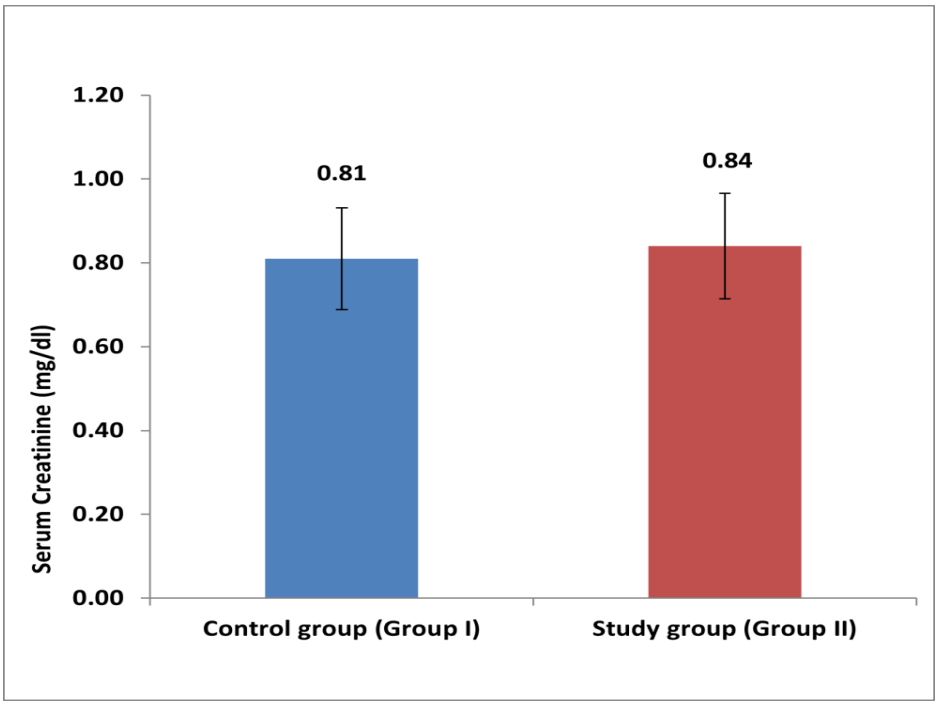

Figure 1: Bar Diagram Showing Mean Value of Serum Creatinine in Both Control and Study Groups

Group I: Control group (younger male), Group II: Study group (elderly male).

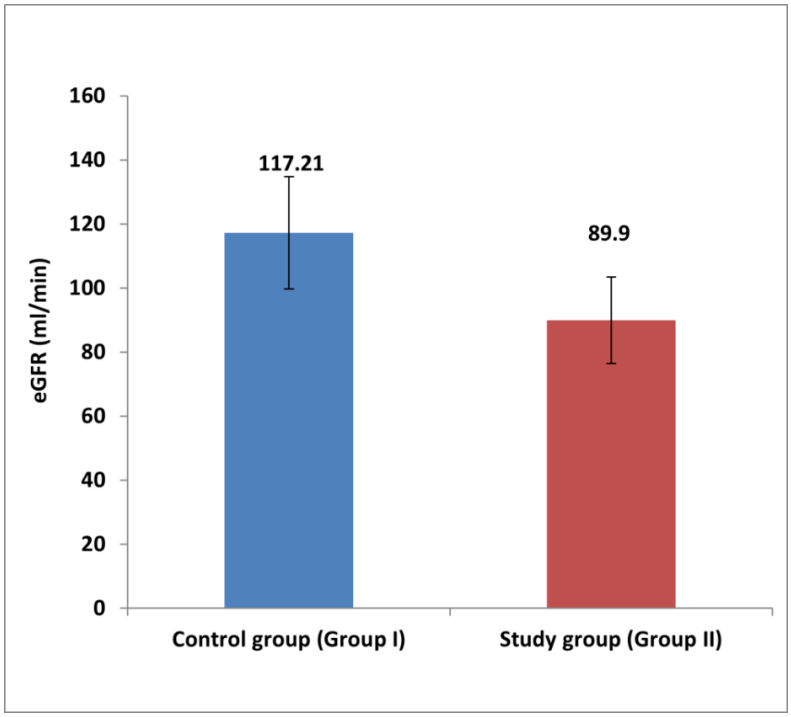

Figure 2: Bar Diagram Showing Mean Value of eGFR in Both Control and Study Groups

Group I: Control group (younger male), Group II: Study group (elderly male).

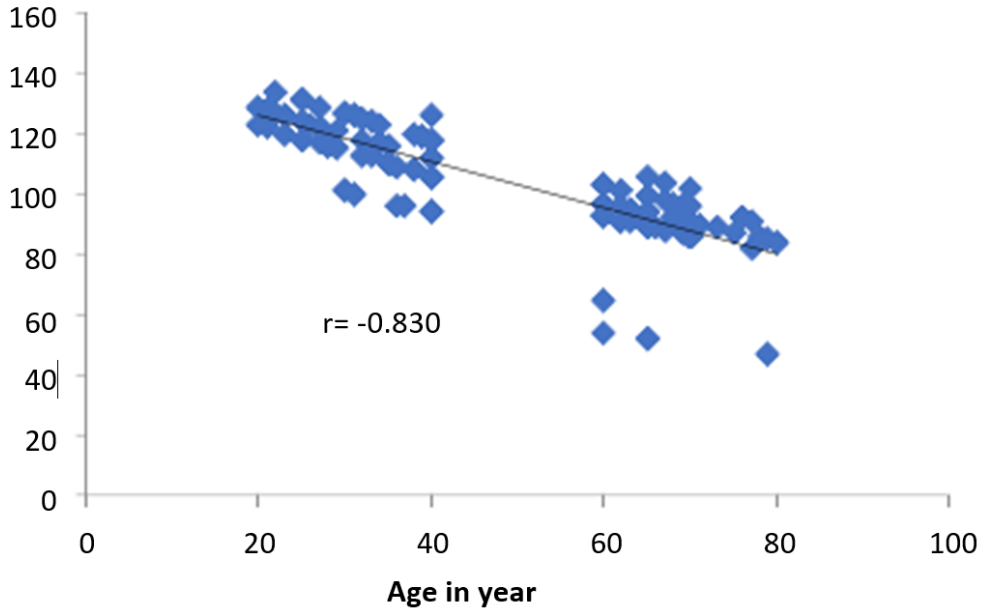

Figure 3: Scatter Diagram Showing Negative Correlation of Estimated Glomerular Filtration Rate (eGFR) With Age

r = correlation coefficient

Control group (Group I): Younger male group (20-40 years), Study group (Group II): Elderly male group (60-80 years).

DISCUSSION

In this study serum creatinine was slightly increased (non-significant) in the study group in comparison to the control group. Similar findings were obtained from the study of Rowe *et al.* and Culleton.[13, 14] Teitz *et al.*, showed serum creatinine remains unchanged in

healthy elderly persons due to the progressive decrease in muscle mass.[15] Some researchers suggested that the cause of decline in serum creatinine in elderly is a protein- and meat-reduced diet, increased excretion by tubular secretion or gastrointestinal elimination16. In this study, there was significantly decreased eGFR in study group in comparison to control group and the result was highly significant at 1% level of probability ($p<0.001$). Similar findings were obtained from study of Cohen *et al.*, Fehrmen-Ekholmn I & Skepplohmn L, Musab, Coresh *et al.*[17-20] A series of studies by Fliser *et al.*, proposed that age-related decline in GFR is largely driven by a vascular (arterial) process.[21] It was tempting to speculate that nephrosclerosis and GFR decline are linked. There is evidence that cortical atrophy with aging is linked to the same process that causes GFR decline.[22]

With normal aging, the number of nephrons gradually decreases. After age 40 years, the number of functioning nephrons usually decreases about 10 percent every 10 years; thus, at age 80 years, many people have 40 percent fewer functioning nephrons than they did at age 40 years.[23] Huber *et al.*, Wiggins *et al.*, Zhang *et al.* hypothesized that progressive reduction in number of viable and normally functioning podocytes, along with decreased capacity for their regeneration and repair, ultimately lead to glomerular obsolescence and also subtle deterioration of the integrity of slit pore membrane in glomeruli, affecting whole kidney GFR.[24-26] Hoang *et al.* demonstrated reductions in GFR and RBF and a significant reduction in kf (Filtration coefficient) as compared with subjects under the age of 40, those over the age of 55.[27] The reduction in Kf was calculated to result from reductions in both the glomerular capillary permeability and the surface area available for filtration. In addition, a primary reduction in afferent arteriolar resistance is associated with an increase in glomerular capillary hydrostatic pressure. These hemodynamic changes occur in concern with structural changes, including loss of renal mass; hyalinization of afferent arterioles and in some cases, development of aglomerular arterioles; an increase in the percentage of sclerotic glomeruli and tubulointerstitial fibrosis.[28] Abdulkader *et al*. suggested that a decreased GFR in the elderly is strongly indicative of the presence of hypertension and other comorbidities.[29]

CONCLUSION

From the present study it can be concluded that age has an appreciable effect on renal function status. Although age related decline in GFR was formerly considered part of normal aging, decreased GFR in the elderly is an independent predictor of adverse outcomes such as death and cardiovascular disease. Older age is a risk factor for development of chronic kidney disease, most likely reflecting both lower mean level of eGFR and higher rate of renal function loss in older compared with younger. So early detection of impairment of kidney function can prevent severe age-related complications of kidney.

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REFERENCES

1. Knight J, Nigam Y. Exploring the anatomy and physiology of ageing. Part 1--The cardiovascular system. Nursing times. 2008 Aug 1;104(31):26-7.
2. World Health Organization, editor. World health statistics 2008. World Health Organization; 2008.
3. BBS S. Population and housing census 2011 (Bangladesh).
4. World Population Prospects (1950–2050 United Nations (UN) (2007). World Population Ageing 1950–2050, Population Division, DESA, UN, 2007.
5. O, Sullivan E D, Hughes J & Ferenbach D A, Renal Aging: Causes and Consequences, J Am Soc Nephrol. 2017; 28:407-420.
6. U.S. Renal Data System, USRDS. Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, USA. 2013. www.usrds.org/adr.aspx
7. Huda MN, Alam KS, Harun Ur R., Prevalence of chronic kidney disease and its association with risk factors in disadvantageous population. Int J Nephrol.2012; 267-329.
8. Passos VMA, Barreto SM, Lima-Costa MFF.,Detection of renal dysfunction based on serum creatinine levels in a Brazilian community: the BambuõÂ Health and Ageing Study. Brazilian J Med Biol Res. 2013; 36:393-401.
9. Zhanga y, Zuob xi, Huangb ZH, Kuanga ZM, Luc Mi, Duand DD, The Impact of Blood Pressure on Kidney Function in the Elderly: A Cross-Sectional Study. Kidney Blood Press Res. 2013; 38(0): 205–216.
10. Roderick PJ, Atkins RJ, Smeeth L et al, CKD and mortality risk in older people: a community-based population study in the United Kingdom. Am. J. Kidney Dis. 2009: 53, 950– 960.
11. Tsimtsiou Z, Karakoula K, Efthymiadou E, Asimakopoulos A, Fardi B, et al, Evaluating Kidney Function in Elderly Population: A Cross-Sectional Study in Primary Health Care. J Gerontol Geriatr Res. 2017; 6: 384.
12. Shlipak M G, Katz R, Kestenbaum B, Linda F F, Newman A B, Siscovick D S et al, Rate of Kidney Function Decline in Older Adults: A Comparison Using Creatinine and Cystatin C, Am J Nephrol. 2009; 30:171–178.
13. Rowe JW, Andres R, Tobin JD, Norris JH, Shock NW. The effect of age on creatinine clearance in man. A

cross sectional and longitudinal study. J Gerontol, 1976; 31:155-63.
14. Culleton BF, Larson MG, Evans JC, et al. Prevalence & correlates of elevated serum creatinine levels: the Framingham Heart Study. Arch Intern Med.1999; 159, pp 1785-1790.
15. Teitz NW, Shuney DF, Wekstein DR, Clinical laboratory values in the aging population, Pure and Applied Chemistry. 1997; 69(1):51-53.
16. Perrone RD, Madias NE, Levey AS, Serum creatinine as an index of renal function: new insig8hts into old concepts. Clin Chem. 1992; 38:1933–53.
17. Cohen E, Nardi Y, Krause I, Goldberg E, Milo G, Garty M, Krause I, A longitudinal assessment of the natural rate of decline in renal function with age. J Nephrol, 2014; 27: 635– 641.
18. Fehrman-Ekholm I, Skeppholmn L, Renal Function in the Elderly (>70 Years Old) Measured by Means of Iohexol Clearance, Serum Creatinine, Serum Urea and Estimated Clearance, Scand J Urol Nephrol, 2004; 38;73.
19. Musab S. H., Richard J. G. and Andrew D. R. Structural and Functional Changes in Human Kidneys with Healthy Aging. J Am Soc Nephrol. 2017; 28: 2838–2844.
20. Coresh J, Astor BC, Greene T, Eknoyan G, Levey AS. Prevalence of chronic kidney disease and decreased kidney function in the adult U.S. population: Third National Health and Nutrition Examination Survey. Am J Kidney Dis. 2003; 41(1), pp. 1-12.
21. Fliser D, Ritz E. Relationship between hypertension and renal function and its therapeutic implications in the elderly. Gerontology. 1998; 44(3):123–131.
22. Wang X, Vrtiska TJ, Avula RT, et al., 2014, Age, kidney function, and risk factors associate differently with cortical and medullary volumes of the kidney. Kidney Int. 2014; 85(3):677– 685.
23. Hall JE. Textbook of Medical physiology, 13th edition, Reed Elsevier, India, 2016; pp. 325, 337, 951, 952, 953, 960.
24. Huber TB, Edelstein CL, Hartleben B, et al., 2012, Emerging role of autophagy in kidney function, diseases and aging. Autophagy. 8(7):1009–1031.
25. Wiggins JE. Aging in the glomerulus. J Gerontol A Biol Sci Med Sci. 2012; 67(12):1358– 1364.
26. Zhang J, Hansen KM, Pippin JW, et al. De novo expression of podocyte proteins in parietal epithelial cells in experimental aging nephropathy. Am J Physiol Renal Physiol. 2012; 302(5): F571–580.
27. Hoang K, Tan JC, Derby G, et al. Determinants of glomerular hypofiltration in aging humans. Kidney Int. 2003; 64:1417-1424.
28. Weinstein JR & Anderson S. THE AGING KIDNEY: PHYSIOLOGICAL CHANGES. Adv Chronic Kidney Dis. 2010; 17(4): 302–307.
29. Abdulkader RCRM, Burdmann EA, Lebrão MLC, Duarte YA, Zanetta DMT. Aging and decreased glomerular filtration rate: An elderly population-based study. PLoS ONE. 2017; 12(12): e0189935.