

Age adjusted creatinine clearance in normal subjects and in patients with renal disorders

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Abstract

Serum creatinine, urinary creatinine and endogenous creatinine clearance were measured in various age groups in normal subjects and in those suffering from renal disorders. Serum creatinine was found to be significantly high in cases of chronic renal failure and renal hypertension. Serum and urinary creatinine levels in normal subjects were found to vary with the age. (JPMA 31:225, 1981).

Introduction

Determination of serum creatinine is being extensively used as a tool for clinical investigation of renal function (Edwards and Whyte, 1959; Effersoe, 1957; Steinitz and Turkand, 1940; Enger and Blegen, 1964). Lewis and Alving(1938), Davies and Shock (1950), Miller et al. (1952) and Watkin and Shock (1955) have reported a significant decrease in glomerular filtration rate (GFR) with increasing age. Various workers (Dubach et al., 1967; Josefson, 1963; Kuhlback et al., 1964) have observed no significant change in serum creatinine levels of normal subjects of different age groups. These two facts suggest a decreased endogenous creatinine production with age accompanied by decreased urinary creatinine excretion per Kg body weight (Ahlert et al., 1967).

Creatinine clearance is an index of GFR and can be readily determined in the laboratory. An attempt has been made by the Council on the Kidney in Cardiovascular Disease (1971) to classify the severity of renal disorders on the basis of creatinine clearance as compared to normal subjects. Present work was carried out to formulate age adjusted values of creatinine clearance in normal subjects as well as patients suffering from various renal diseases. In this study we have estimated serum creatinine, urinary creatinine excretion and endogenous creatinine clearance in various age groups in normals as well as in patients.

Material and Methods

Seventy four patients (34 males and 40 females), with renal diseases admitted to the Nephro-urology department of Jinnah Postgraduate Medical Centre, Karachi, were studied. They were classified on the basis of clinical diagnosis into 5 groups. (Tables I and II).

Table I

Serum creatinine, urinary creatinine and creatinine clearance in normal subjects of different age groups.

<i>Ages (Years)</i>	<i>n</i>	<i>SC mg/100 ml</i>	<i>UC mg/100 ml</i>	<i>CCr ml/min/ b.s.a.</i>
5—9	10	0.45	85.9	91.04
	10	± 0.04	± 8.28	± 9.18
10—19	12	0.68	102.6	143.10
		± 0.05	± 12.90	± 16.33
20—29	9	0.74	153.5	169.0
		± 0.06	± 28.8	± 26.98
30—39	11	0.63	148.0	143.9
		± 0.05	± 23.76	± 30.09
40 and above	23	0.78	140.0	119.0
		± 0.08	± 16.18	± 14.65

SC — Serum creatinine
 UC — Urinary Creatinine
 CCr — Creatinine Clearance
 n — No. of Observations
 ± — Standard Error of the mean
 b.s.a. — Body surface area

Table II

Serum creatinine, urinary creatinine and creatinine clearance in patients suffering from various renal diseases.

<i>Disease</i>	<i>(n)</i>	<i>SC</i> <i>mg/100 ml</i>	<i>UC</i> <i>mg/100 ml</i>	<i>CCr</i> <i>ml/min/</i> <i>b.s.a.</i>
1. Calculus and Stones	(16)	0.76 ± 0.06	174.6 ± 17.9	146.8 ± 17.9
2. U.T.I.	(10)	0.63 ± 0.04	119.9 ± 17.56	148.62 ± 18.89
3. Nephrotic syndrome	(17)	0.83 ± 0.11	83.1 ± 8.88	92.35 ± 11.93
4. Renal Hypertension	(6)	4.31 ± 1.47	71.6 ± 16.82	46.0 ± 26.12
5. C.R.F.	(16)	5.77 ± 1.58	60.5 ± 12.40	21.50 ± 9.59

SC — Serum creatinine
 UC — Urinary creatinine
 CCr — Creatinine clearance
 n — No. of observations
 ± — Standard error of the mean
 b.s.a. — Body surface area.

Sixty five normal subjects (29 males and 36 females) of different age groups were randomly selected from the volunteers and patients' attendants. They were also divided into 5 groups according to their age.

Blood and 24 hours urine samples were collected from both patients and normal subjects under

standard conditions. Body weight (Kg.), and height (Cm.) were recorded. Creatinine was estimated by alkaline picrate method as described by Bonsnes and Taussky (1945).

Results

The results of serum creatinine, urinary creatinine and creatinine clearance in normal subjects of different age groups are shown in table 1. Serum creatinine levels were found to be 0.45 mg/100 ml in children between 5 and 9 years of age. These values increased gradually with the age. Similarly, urinary creatinine (85.9 mg/100 ml in children of 5 to 9 years of ages) also showed an increase with age but the change was found to be more significant and reached a maximum at the age of 20-29 years and then declined again. Endogenous creatinine clearance in terms of ml/min/body surface area of 1.73 m² followed a similar pattern, i.e., initially there was an increase of about 30-40 ml/min/b.s.a. every 10 years and then a decline of about 20-30 ml/min/b.s.a. every 10 years after the age of 30.

Table II shows the serum and urinary concentrations of creatinine as well as creatinine clearance in patients suffering from various renal disorders. Creatinine clearance was normal in patients with calculous disease and U.T.I. Patients suffering from nephrotic syndrome, renal hypertension and chronic renal failure showed significant changes. Patients with nephrotic syndrome had normal serum creatinine level, but significantly lower urinary creatinine and creatinine clearance. In renal hypertension and chronic renal failure serum creatinine levels were significantly elevated (4.31 and 5.77 mg/ml respectively) and urinary creatinine (71.6 and 60.5 mg/100 ml) and creatinine clearance (46 and 21.5 ml/min/b.s.a.) were significantly reduced.

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Discussion

Estimation of serum creatinine has been widely adopted as a screening test for renal function in clinical practice (Edwards and Whyte, 1959; Effersoe, 1957; Steinitz and Turkand, 1940). The evaluation of serum creatinine concentration is an indicator of renal dysfunction. Over sixty years ago, serum creatinine was considered the most significant non protein nitrogenous substance in the prognosis of renal failure (Myers and Killian, 1913). The absolute values of serum creatinine found in the present

studies are significantly lower than those observed in other studies (Kampmann et al., 1974; Van Pilsun and Seljeskog, 1958). These values were also found to be dependent upon age. We also observed a high concentration of serum creatinine in chronic renal failure and renal hypertension. The serum creatinine in such patients may be as high as 10 mg% in individual cases.

Urinary creatinine excretion was found to be significantly lower than reported by Kampmann et al. (1974). The relationship between age and creatinine excretion was found to be nearly the same as between age and serum creatinine.

The values for creatinine clearance in this study were higher than those reported by other workers (Muther, et al., 1967; Davies and Shock, 1950; Galnares and Volumen, 1970; Hansen et al., 1970; Hollenberg, et al., 1970) but an inverse relationship of creatinine with age has also been observed by others.

The standard errors for creatinine clearance were large, most probably due to the method of collection of urine specimens. Creatinine clearance was found to be within the normal limits in patients suffering from calculous diseases and urinary tract infection but significantly reduced in patients suffering from nephrotic syndrome, renal hypertension and chronic renal failure.

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