Renal Function in the Elderly

A.		Hadj-Aïssa ^a
C.		Dumarest ^b
P.		Maire ^b
N.		Pozet ^a

^aService d'Exploration Fonctionnelle Rénale, Hôpital E. Herriot, Pavillon P, et
^bLaboratoire de Pharmacie, Hôpital Gériatrique A. Charial, Lyon, France

Dr. Aoumeur Hadj-Aïssa, Service d'Exploration Fonctionnelle Rénale, Hôpital Edouard Herriot, Pavillon P, Place d'Arsonval, F-69437 Lyon Cedex 03 (France)

Dear Sir,

Numerous studies have shown that glomerular filtration rate (GFR) is decreased in the elderly, without concomitant increase in plasma creatinine (Per), unlike in younger patients with pathologically decreased GFR [1, 2]. However the range of actually observed GFR and corresponding Per in the normal elderly people are not clearly defined, compared to younger patients with chronic renal insufficiency and similar level of renal function.

The present study has been performed in 42 patients (group 1, 35 women and 7 men) hospitalized in a geriatric hospital, aged 66–95 years (78.86 ± 6.88), and weighing 32.8–77.5 kg (56.42 ± 10.45), without clinical history of renal disease. During and at least 1 month prior to the study they have not been treated by nephrotoxic drugs such as aminosides or medication which may affect renal function such as diuretics or non steroidal anti-inflammatory drugs. Patients with urinary incontinence, urinary tract infection, severe denutrition or in situation of increased protein catabolism were not included. In each patient 24-hour urine was collected (from 7 am to 7 am the next day) and blood samples were drawn at the beginning and the end of urine collection periode. Creatinine concentrations were measured on dialyzed samples by an automated technique adapted from the Jaffé reaction (Technicon autoanalyzer AAI-NIIb). Measured creatinine clearance (Ccr) was compared to Ccr calculated from Cockcroft and Gault formula [3].

The same measurements and calculations were made in a group of 58 patients (group 2, 48 women and 10 men) with known chronic renal disease of various etiology, aged 19–65 years (41.98 ± 10.36 , $p < 0.001$ versus group 1), weighing 45.00–79.00 kg (59.6 ± 8.27 , NS versus group 1) and whose measured Ccr was similar to that of group 1. Results are shown in table 1. Our results confirm that aged patients without any clinical or biological criteria of renal disease have a dramatic decrease in renal function as measured by Ccr, whereas mean Per remains within normal limits. There was no correlation between Ccr and 24-hour urine volume, which excludes that the observed range of Ccr (19.93 – 99.97 ml/min/1.73 m²) could be due to incomplete Table 1. Data from old subjects (group 1) and younger patients with chronic renal insufficiency (group 2)

V ml/24 h

UcrV mmol/24 h

Ccr (M) ml/min/1.73 m²
 Ccr (C) ml/min/1.73 m²
 Per μmol/l

Group 1 Group 2 P

1,577 ± 534
 5.98 ± 1.78
 50.54 ± 18.93
 45.12 ± 14.31
 98.53 ± 26.97
 2,623 ± 886
 11.37 ± 2.81
 51.26 ± 20.93
 41.72 ± 17.95
 197.71 ± 103.46
 < 0.01
 < 0.01
 NS
 NS
 < 0.01

Values are expressed as mean ± SD.

V = Urine volume; UcrV = urinary creatinine excretion; Ccr (M) = measured creatinine clearance; Ccr (C) = calculated creatinine clearance.

Renal Function in the Elderly

365

500
 100

GROUP 1 GROUP 2

■ GROUP 1 □ GROUP 2

60 -

0

15 35 55 75 95

Creatinine clearance (ml/min/1.73m²)

Fig. 1. Correlation between measured Ccr and Per. Nonlinear regression: group 1: $y = 505.40 \times x^{-0.43}$; $r = 0.73$; $p < 0.001$; group 2:

$y = 7,090.25 \times x^{-0.90}$; $p < 0.001$.

100

Measured creatinine clearance (ml/min/1.73m²)

Fig. 2. Correlation between measured Ccr and Ccr calculated by means of Cockcroft's formula:

$Ccr = 1.23 \times (x)^{0.85} \text{ for women} \times 0.72 \times Per \text{ (mg/100 ml)}$

Linear regression: group 1: $y = 20.50 + 0.49 \times$; $r = 0.64$; $p < 0.001$; group 2: $y = 1.99 + 0.78 \times$; $r = 0.90$; $p < 0.001$.

urine collection in patients with the lowest Ccr. This phenomenon becomes obvious in figure 1, which depicts the correlation between Ccr and Per in the 2 groups of patients.

The lack of increase in Per in these patients is related to a decreased creatinine production due to the reduction in lean body mass, as indicated by the lowest urinary creatinine excretion compared to the group of younger patients with established renal failure and similar Ccr (table 1).

As for the possibility to use formulas to calculate Ccr, figure 2 shows that it was a significant correlation between measured Ccr and calculated Ccr in the 2 groups although weaker in the aged group. However as shown in table 1, mean calculated Ccr is significantly lower than measured Ccr in both groups. This is probably related to the fact that original formulas derived from data on patients aged 18–92 years, amongst whom only 23% were aged more than 70 years and only 4% were women.

In conclusion, this study shows the extreme dispersion of GFR in old patients without evident criteria of renal disease. Per cannot predict in these patients the level of GFR. Cockcroft and Gault's formula using Per and a correction for age, body weight and sex may be useful to predict Ccr before treating patients with a potentially toxic drug known to be excreted mainly or exclusively by the kidney, although calculated Ccr with this formula underestimates true Ccr. However this formula must not be used for the survey of renal function in patients treated by nephrotoxic drugs, since it does not take into account urinary creatinine excretion which begins to decrease before the increase in Per.

References

Brown W.W.; Davis, B.B.; Spry, L.A.: Aging and the kidney. *Archs intern. Med.* 746:1790–1796 (1986).

Rowe, J.W.; Andres R.; Tobin J.D.; Norris A.H.; Shock N.W.: The effect of age on creatinine clearance in men. *J. Gerontol.* 31: 155–163 (1976).

Cockcroft, D.W.; Gault, M.H.: Prediction of creatinine clearance from serum creatinine. *Nephron* 76:31–41 (1976).