Urea Distribution Volume Is Not Constant in Hemodialysis Patients

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Dear Sir,

In a recent issue of your Journal, Maduell et al. [1] suggested that the urea distribution volume (V) is virtually constant in every hemodialysis (HD) patient.

We decided to reanalyze the data of 78 dialysis sessions (HD and hemodiafiltration) of 12 stable uremic patients (9 males and 3 females) on thrice-weekly HD. These dialysis sessions had been the object of a previous publication of our own, dealing with a simplified calculation of Kt/V [2]. All dialysis runs were performed with a Monitral monitor (Hospal, Italy). Each patient underwent up to a maximum of 12 experimental HD and hemodiafiltration sessions using cuprophane (Hospal, Italy), polyacrylonitrile AN 69 (Hospal, Italy), and polysulfone dialyzers (Frese-nius, Germany) (surface area ranging between 1.0 and 1.25 m²); time ranged between 90 and 270 min, blood flow rate between 350

U and 400 ml/min and dialysate flow rate between 500 and 550 ml/min. The dialysis sessions were analyzed with the technique of the direct dialysis quantification [3]; the spent dialysate was collected in a calibrated drum, and dialysate urea nitrogen was determined in duplicate from a well-mixed sample of the total volume. Blood samples, collected from the arterial line at the start and at the end of the session, were used to measure serum urea nitrogen and total plasma protein concentration. Serum urea nitrogen was then converted to plasma water urea nitrogen (pwUN) by using the volume fraction of plasma proteins [4]. The V value was calculated according to the following formula:

$$V = \frac{pwUN_i - pwUN_f}{U}$$

where U is the total amount of urea nitrogen collected in the dialysate, pwUN_i and pwUN_f are the pwUN concentrations at the start and at the end of the dialysis run, respectively. Data (means ± SD) are shown in table 1. The V value is expressed as a percentage of body weight in table 1 and in the following discussion. Statistical analysis was done using one-way analysis of variance.

Two points of discrepancy exist between our data and those of Maduell et al. [1]. The first is the nonconstant V value in our patients. When analyzing the range of V values in each individual patient (e.g. patient 1 of our series had a range from 40.8 to 63.8, i.e. a value of 23), we found that the mean value in our 12 patients was 17.4 ± 10.1 versus 4.8 ± 1.5 of the

35 patients of Maduell et al. [1] ($F 53.08$, $p < 0.0001$). The reason for this discrepancy is far from being clear.

Table 1. Urea distribution volume, expressed as percentage of body weight, in 78 dialysis runs of 12 uremic patients

The second point of discrepancy is the significantly lower mean V value obtained in our 78 dialysis sessions compared with that obtained in the 210 dialysis runs of the patients of Maduell et al. [1] (49.1 ± 7.2 vs. 55.6 ± 1.8 , $F_{24,88}$, $p < 0.0001$). When measuring V by means of direct dialysis quantification Aebischer et al. [5] found a mean value of 52.1 ± 9.2 ($n = 60$) and Ellis et al. [6] a mean value of 53.0 ± 8.4 ($n = 48$). Ilstrup et al. [7] found a mean V value of 49 ± 4.3 , when measuring it in 3 uremic patients by means of standard dilution techniques of intravenously injected sterile urea. Finally, very recently Keshaviah et al. [8] repeated the same experiments as Ilstrup et al. [7] in 15 HD patients, finding a mean V value of 47.8. More precisely, it was higher in the 8 males (51.3) than in the 7 females (43.7) [8].

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