Dear Sir,

It is generally recognized that anemia is a common symptom of chronic renal failure which causes a number of serious problems to the patient. Some studies claim that, in hemodialysis patients, success in treating anemia depends on the efficacy of dialysis therapy. The importance of adequate hemodialysis for successful control of anemia has recently received authoritative support especially by a study conducted by Ifudu et al. [1].

Regarding the relationship between anemia and efficacy of continuous ambulatory peritoneal dialysis (CAPD), it has been explored to a much lesser extent than was the case for hemodialysis, and, what is more, the results are controversial. While some studies have not demonstrated an association, other authors have, even though in case reports [2-4]. Because of the paucity of unambiguous information, we conducted a study designed to establish whether or not the renal anemia in patients with chronic renal failure is affected by the adequacy of CAPD.

We examined 22 patients with a mean age of 51.8 (20-79) years (arithmetic mean and range) treated by CAPD (Twin-Bag System; Baxter, Deerfield, Ill., USA) for 14.8 (1.5-52) months for chronic renal failure caused by chronic tubulointerstitial nephritis in 8 cases, chronic glomerulonephritis in 7, diabetic nephropathy in 5, polycystic kidney disease in 1, and Fanconi’s syndrome in 1 case. None of the patients received recombinant human erythropoietin or blood transfusion for renal anemia. At the same time the hematocrit was 30.9% (19.4-43.3). The KT/V index had not changed for 6.3 (1.5-24) months prior to the study when it was at 2.0 (1.4-2.8) per week. The residual glomerular filtration rate (GFR) was 4.8 (0.9-4.1) ml/min.

The efficacy of blood purification was assessed by the KT/V index considering both peritoneal and renal urea clearances \(\left[\text{KT/V} = \left(D_{\text{urea}}/P_{\text{urea}} \cdot V_D + C_{\text{urea}}\right)/V_{\text{tot}}\right]\) and by weekly creatinine clearance corrected for body surface area (BSA), again considering both peritoneal and renal eliminations \(\left[C_{\text{crea}/\text{BSA}} = D_{\text{crea}}/P_{\text{crea}} \cdot V_D \cdot 7 + \text{GFR}_{\text{rest}}\right]\). The residual GFR was determined as the arithmetic mean of urea and creatinine clearances \(\left[\text{GFR}_{\text{rest}} = (C_{\text{urea}} + C_{\text{crea}})/2\right]\) [5]. Besides the hematocrit, we examined, using standard methods,
albumin and the transferrin as nutritional markers and transferrin saturation to determine the iron status. The relationships between hematocrit and other parameters were assessed using correlation coefficients, simple regression analysis, and step-wise regression analysis. The group of patients was divided into a subgroup with $KT/V < 2.3$ and one with $KT/V \geq 2.3$. The subgroups were then compared by the unpaired t test.

We demonstrated a statistically significant positive correlation between hematocrit and $KT/V$ ($r = 0.65, p = 0.001, y = 15.3 + 7.7x$). There was also a significant positive correlation between hematocrit and creatinine clearance ($r = 0.50, p = 0.02, y = 23.8 + 0.08x$), although it was less close and at a lower level of significance than that between hematocrit and $KT/V$. A still looser, yet still statistically significant correlation was demonstrated between hematocrit and residual renal function ($r = 0.43, p = 0.04, y = 26.8 + 0.9x$). There was no significant correlation between hematocrit and the other parameters, be they age, CAPD duration, serum albumin and transferrin concentrations, or transferrin saturation. Pearson’s correlation coefficients are included. The same associations were established when using Spearman’s correlation coefficient and, also, Box-Cox transformation. As has been mentioned above, we also used stepwise regression analysis selecting of all variables considered those which affect the dependent variable (hematocrit in our case) the most. Of all the considered variables, i.e., $KT/V$ index, CAPD duration, serum albumin, creatinine clearance, serum transferrin, transferrin saturation, and patients’ age, stepwise regression analysis identified only $KT/V$ index and CAPD duration as important factors with an effect on hematocrit. The relationship between the $KT/V$ index and hematocrit was direct with a regression coefficient of 0.66 and statistical significance at a level of 2%.

The relationship between CAPD duration and hematocrit was indirect with a regression coefficient of -0.01 at the 4% level of significance. The final model of analysis has an R² value of 0.44 which indicates that 44% of the variation in hematocrit is explained by the two variables included in the model, i.e.,

KAIUIEH
E-Mail karger@karger.ch Fax + 41 61 306 12 34 http://www.karger.ch
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by $KT/V$ and CAPD duration. Judging by the results emerging from the CANUSA study [6], it appears that $KT/V$ values $> 2.3/ week$ are associated with a lower mortality. With this in mind, we divided our group of 22 patients into a subgroup with a $KT/V > 2.3$ (n = 7) and into one with a $KT/V < 2.3$ (n = 15). A comparison of these two subgroups revealed that they did not differ statistically significantly with regard to age, CAPD duration, serum albumin, and transferrin concentrations, or transferrin saturation. Needless to say, the subgroups did differ significantly, by definition, in $KT/V$ ($2.61 \pm 0.07$ vs. $1.76 \pm 0.07$, $p = 2E-7$; arithmetic mean $\pm$ SEM), and, in weekly creatinine clearance ($116.6 \pm 9.6$ vs. $83.1 \pm 7.75$ litres/week/1.73 m² BSA; $p = 0.02$). A statistically significant difference was also found in residual GFR ($6.65 \pm 0.92$ vs. $3.96 \pm 0.69$ ml/min, $p = 0.03$). A fact we regard as especially important is that we demonstrated a statistically significant difference between both subgroups with regard to hematocrit. The subgroup with a higher $KT/V$ had a hematocrit of $35.1 \pm 1.95\%$, while the hematocrit of the subgroup with a lower $KT/V$ was $28.9 \pm 1.20\%$ ($p = 0.009$).
We have formulated, based on our results, the following conclusions: (1) anemia in CAPD patients markedly depends on the total of therapy characterized, in particular, by the KT/V(peritoneal+renal) index; (2) the anemia becomes less distinct as the KT/V(peritoneal+renal) increases; (3) the degree of anemia should be included as a marker of the adequacy of CAPD, and (4) studies to determine to what extent anemia depends on KT/V due to peritoneal dialysis and on KT/V due to residual renal function are warranted.

References