



Adequacy on hemodialysis: the session time factor

F. Locatelli

Department of Nephrology and Dialysis. Azienda Ospedale di Lecco, Lecco. Italy.

During the past 30 years there has been a striking increase in the incidence of end stage renal disease (ESRD). Moreover, features of the dialytic population have shown substantial modifications: the nowadays population is considerably older and has a higher incidence of comorbidity factors (mainly vascular diseases and diabetes mellitus), heavily conditioning morbidity and mortality. Cardiovascular diseases account for more than 50% of mortality in hemodialysis patients, who have an incidence of cardiac death that is 5-10 times higher than that of the age-matched general population. The rate of cardiovascular disease is not only elevated in diabetics or primary hypertensives, but also among patients with chronic glomerulonephritis, thus leading to the definition of CRF as a «vasculopathic state».

When trying to define the dialysis adequacy, its two main determinants (delivered dialysis dose and treatment time) must be reanalyzed by considering the above summarized epidemiological and clinical features of nowadays dialysis population.

DIALYSIS DOSE

After the introduction of the concept of dialysis dose quantification, the American National Cooperative Dialysis Study (NCDS) stands a milestone since it first demonstrated that patient morbidity and treatment failure are related to the inadequate dialysis dose (together with acidosis and electrolyte derangement). After that, a linear correlation of lower mortality with higher dose of hemodialysis therapy was suggested by several reports and then strongly supported by the results of a historical prospective study in a national random sample of over 2,300 Medicare ESRD patients, with a statistical adjustment for an extensive list of comorbidity/risk factors. Mortality risk resulted lower by 7% ($p = 0.001$) with each 0.1 higher level of delivered Kt/V (at least under a Kt/V of 1.3), thus making the quantification of the delivered dialysis dose essential in treatment management.

Unfortunately, the delivered dialysis dose is only

quantified from time to time because the easier single pool variable volume urea kinetic model, as well as the simplified methods proposed by Smye and Daugirdas to calculate the Kt/V require the taking of blood samples to determine urea concentrations and thus are not suitable for routine use. The sometimes large difference between prescribed and delivered dialysis implies the risk that treatment inadequacy may go unnoticed. The main problem currently facing us is therefore to find a reliable, easy, non-invasive and inexpensive method of determining Kt/V, ideally at each dialysis session. The conductivity method, allowing the routine assessment of delivered dialysis without the need for blood or dialysate sampling, is undoubtedly a very promising means.

TREATMENT TIME

In the 1980's, a surprising result was highlighted: European and Japanese ESRD patients had a better survival than those treated in the USA. An analysis of the dialysis prescriptions made in 1986 and 1987 found that the prescribed level of dialysis in the USA was substantially lower than in Europe; furthermore, the most striking feature of these lower hemodialysis dose was the progressive decrease in the duration of dialysis sessions, which were 23.5% shorter than in Europe and 40% shorter than in Japan. Looking at the 1983-1996 data of the Lombardy Registry of Dialysis and Transplantation, the decrease in dialysis time is also very evident, even if the survival of Lombardy patients is not decreasing and is still far better in comparison with those treated in the USA (even after adjustment for comorbidities). The number of dialysis sessions lasting less than three hours (three times/week) has increased from 4% to 16.3%; the number of those lasting 3-4 hours has increased from 55.4% to 71.6%; and the number of those lasting 4-5 hours has decreased from 39.9% to 11.8%.

The widespread trend towards shortening the duration of dialysis sessions has been driven by a number of factors (the cost/effectiveness ratio, patient-

staff convenience, improved technology), but its justification is founded on the evolution of scientific knowledge. The introduction of the concept of the square meter hour hypothesis in 1971 suggested that dialysis time could be shortened with impunity as long as the dialyzer surface area was increased to yield the same surface area \times time product.

The re-analysis of the data provided by the NCDS had also an important effect on the prescription of the duration of dialysis sessions. Given that the correlation between outcome and treatment time only showed a non-significant trend ($p = 0.06$) and there was no difference in the way that Kt/V of more than 1.0 was reached, it was assumed that the value of t could be safely reduced provided that K was increased in order to maintain the $K \times t$ product constant. In fact, the ability to increase the solute removal rate has created a conceptual difference between treatment time and treatment «dose»: a short treatment time is no longer synonymous with less therapy, and long treatment sessions do not necessarily imply more solute removal. However, the impressive results obtained by Charra (after three months on long hemodialysis, 95% of the patients are normo-

tensive without antihypertensive medication and their mortality is lower) underline the importance of treatment time in relation to an additional aspect of dialysis adequacy besides depurative adequacy: achieving dry body weight and thus normalizing blood pressure. On the other side around, intradialytic hypotension is the main acute complication of hemodialysis. Blood pressure control in patients on chronic hemodialysis basically depends on the maintenance of normal or near-normal extracellular volumes. If dialysis fails to ensure adequate salt and water removal, hypertension will usually persist despite the use of antihypertensive medication. Longer dialysis sessions, avoiding the high hourly ultrafiltration rates that often cause severe hypotensive episodes, make fluid removal easier and thus allow to reach dry body weight and control blood pressure. Moreover, they allow better correction of electrolyte and acid-base imbalance. Therefore, in order to prescribe an adequate dialytic treatment, sufficient emphasis must be put on the duration of dialysis *per se*, even if economic reasons and patient wishes make it undoubtedly difficult to lengthen the duration of dialysis sessions.