I.4 Measurement of residual renal function in HD

Introduction

Measurement of residual renal function is well established in CAPD but there is no current recommended method for measuring residual renal function in HD. To address this, these guidelines also include a recommendation for a standard method for measuring and reporting residual renal function in HD.

Guideline I.4

A. To assist in the standard reporting of residual renal function in HD:

- Residual renal function should be reported as GFR and expressed in ml/min/1.73 m² as in pre-ESRD. (Evidence level: C)
- GFR should be estimated as the mean of urea and creatinine clearance using urine collections as in CAPD and pre-ESRD. (Evidence level: C)
- Because residual renal function may vary over the interdialytic period, the urine collections should be made over the entire interdialytic interval (usually 2 days). (Evidence level: C)
- The mean blood urea and creatinine concentrations during the collection period should be estimated as the mean of the post-HD concentration immediately after dialysis (after rebound correction; see Appendix) and the pre-HD value immediately before the following dialysis. (Evidence level: C)
- To convert GFR to Kt/V the Casino and Lopez [72] method should be used. (Evidence level: C)

Commentary on Guideline I.4

Currently, residual renal function is not routinely measured in HD. On the other hand, current guidelines and practice recognize the critical importance of residual renal function in CAPD [71,73–79].

In CAPD, residual renal function provides a significant and often crucial contribution to overall clearance, at least in the first 2 years of dialysis [71].

In the past, the renal contribution to clearance was ignored in both HD and CAPD. Residual renal function was assumed to fall to zero soon after starting dialysis. It was only after residual renal function was routinely measured in CAPD, that its true importance was discovered. There is now a well-validated and universally accepted method for quantifying residual renal function in CAPD, based on urine collections [71].

In HD, there is no validated and universally accepted method for measuring renal function. It has been considered to decline faster in HD compared with CAPD [80]. However, the rate of residual renal function decline may be less when patients are treated by biocompatible membranes (see Commentary on HD Guideline III.2), or by ACE inhibitors [81–84].

In HD, it is becoming increasingly recognized that residual renal function is an important contributor to solute clearance, has a favourable effect on outcome [85,86], and may be crucial for phosphate homeostasis [87].

For these reasons, the EBPG group consider that it is now time for guidelines on how to measure residual renal function in HD. For practical reasons, and to standardize between HD and CAPD, we are recommending the same method as used in CAPD as far as possible.

In HD, unlike in CAPD, the blood urea and creatinine concentrations vary over the weekly dialysis cycle. There is also evidence that the GFR also may vary over the dialysis cycle, being lower during and immediately after dialysis and higher before the next dialysis [88]. Therefore, the urine should be collected over a complete dialysis cycle, starting (with an empty bladder) at the start of one dialysis and ending at the start of the next. In order to compensate for
fluctuations in blood urea and creatinine concentrations, the mean of the concentrations immediately after the end of dialysis and immediately before the next dialysis should be used. As there is a significant rebound in concentration after dialysis, especially for creatinine, the post-dialysis concentrations should be corrected using the equation in Appendix II.

Another reason why residual renal function in HD has not been measured routinely is that there is uncertainty on how to include residual renal function in the overall estimation of clearance in a patient on dialysis. It is hard to equate the continuous residual renal function with the intermittent clearance of HD. Dialysis clearance is quantified by Kt/V, an exponential function of cleared mass, whereas renal clearance is a linear function of cleared mass. Recently, a kinetic model has been proposed to relate renal and dialysis clearance (see Commentary on Guideline II. 3.1). The Casino and Lopez method relates Kt/V and dialysis clearance (see Appendix II).

It should be noted that the Casino and Lopez method is based on renal urea clearance rather than GFR. This would have the effect of reducing the value of the residual renal function compared with dialysis (as urea clearance is 30–50% less than GFR). If GFR is used instead of renal urea clearance, an equilibrated Kt/V of 1.2 (the recommended minimum) equates to a GFR of 13 ml/min. This seems more probable than a renal urea clearance of 13 ml/min, which is approximately equal to a GFR of 19 ml/min. For this reason and to standardize with CAPD, the EBPG group recommends GFR as a measure of renal function, rather than renal urea clearance.

References

8. Nooromohamed SE, Katzeres JK, Stapleton JT. Poor correlation between published methods to predict creatinine clearance and measured creatinine clearance in asymptomatic HIV infected individuals. Renal Fail 1998; 20: 627–633 (B)