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Stability of biochemical analytes of end stage renal failure patients on renal replacement therapy for urea-kinetic modeling in the home dialysis setting

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Introduction

Renal dialysis patients have biochemical analysis performed monthly to determine the adequacy of dialysis. These are analysed by taking blood in a clotted gel tube pre- and post-dialysis sessions, immediately centrifuged and sent to the laboratory for analysis.

Certain patients (like home dialysis patients) cannot have the samples immediately centrifuged, as they are taken in a home environment. These are mostly stored in a fridge at 2–8°C and then centrifuged and analysed when reaching the laboratory in 24–48 h. The question then rises of the stability of the biochemical analytes for these samples (urea, creatinine).

Aims

We aimed to assess the stability of urea and creatinine in serum when stored for 2 or 3 days in a fridge uncentrifuged to determine whether home dialysis patients can store their quality assessment blood samples at home.

The secondary aim was to determine whether the timing of samples (either pre-dialysis or post-dialysis) affects the stability of analytes which are stored for 48–72 h.

Methods

We selected 42 haemodialysis patients at our renal unit undergoing blood sampling for urea-kinetic modelling. Pre- and post-dialysis urea and creatinine samples were sent for immediate analysis, and duplicate pre- and post-dialysis samples were analysed after a period of uncentrifuged storage in a fridge at 2–8°C. Of the 42 subjects, 20 of the subjects' samples were stored for 48 h and the rest for 72 h.

Urea and creatinine levels in pre- and post-dialysis in both immediate and stored samples were compared using paired T-tests. K_t/V was calculated from both sets of samples (standard methodology). The calculated K_t/V with these methods was compared using the Bland–Altman technique.

Results

By analysing all the samples, we found no significant difference in urea when analysed immediately in comparison to the stored ones (P = 0.36 and 0.15, respectively). However, pre-dialysis creatinine exhibited a small but significant (P = 0.005) rise after 48–72 h [mean difference + 13.66 (CI 4.5–22.9)].

When storage-time subgroups were examined (48 and 72 h), we found that urea and K_T/V were stable for both pre-dialysis and post-dialysis samples for both storage times (P varying from 0.08 to 0.94) (Figure 1). However, for creatinine, although both pre-dialysis and post-dialysis samples were stable for 48 h storage (P = 0.59 and P = 0.15), when stored for 72 h the pre-dialysis creatinine was not stable (mean difference 24.8, P = 0.002).

By comparing K_t/V calculated from samples analysed immediately, and those analysed after a 48–72 h delay using the Bland–Altman technique, we found a bias of only 0.003 K_t/V units (95% CI 0.012 to −0.007). The 95% limit of agreement was +0.063 to −0.058 K_t/V units.

Conclusion

Patients on home dialysis having assessment of dialysis adequacy may require storage of samples at home for several days before they can be analysed. We found no evidence that the serum urea level changed significantly when stored at 2–8°C for up to 72 h and therefore can be reliably analysed. However, the same cannot be said for creatinine which was not stable, although the magnitude of change in analytes was small. This may be due to the shift of creatinine from cells into plasma as a result of two

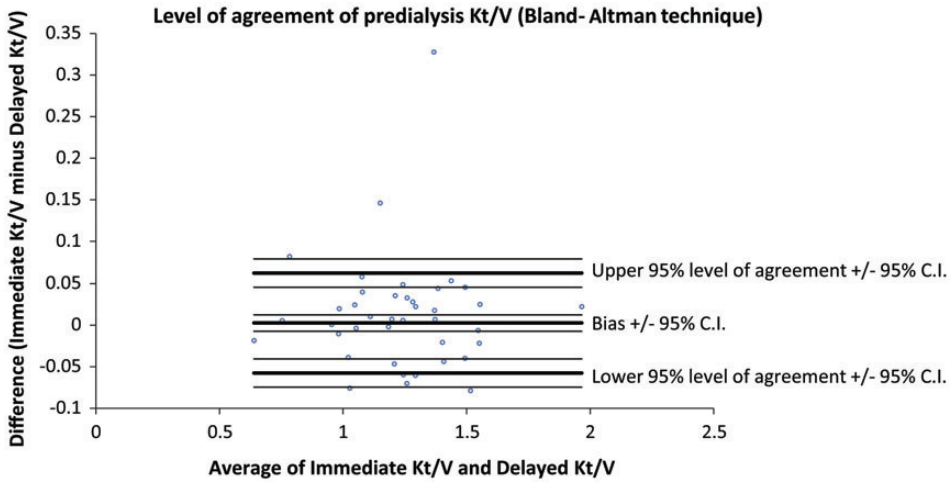

Fig. 1. Level of agreement of predialysis Kt/V.

pool effect. The analysis via Bland-Altman technique demonstrated that K_t/V calculated from stored samples has no significant bias and excellent level agreement compared with K_t/V calculated from samples analysed immediately.

Discussion

In a number of previous articles, we have mentioned adequacy of dialysis in end-stage renal failure patients. The adequacy measured has been partly qualitative and partly quantitative. The quantitative analysis is based on the biochemical analysis of mainly urea, creatinine and β2-microglobulin.

Some of these samples are stored for ∼2–3 days before they are analysed, especially for home haemodialysis patients. However, we have never established in any of our previous articles whether those samples are valid or not. There have been previous studies mentioning stability of analytes, but those were all tested on healthy individuals and not on end-stage renal failure patients [1–3].

Our study shows that the samples remain stable up to 3 days before they are finally analysed. This confirms the validity of adequacy of dialysis, especially for home dialysis patients.

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