than the MDRD equation. MDRD2 (IDMS) has been suggested as an alternative for labs that do not standardize their method to measure serum creatinine. We therefore included the modified MDRD2 (IDMS) for this purpose. We hope that we have emphasized this limitation and presented an argument from the literature (Hallan et al., Am J Kidney Dis 2004; 44: 84), who pointed out that the bias due to a missing calibration decreases as serum creatinine increases, as in kidney transplant patients.

A more disconcerting limitation is the method used to measure cystatin C. We have been assured by BioVendor that in this ELISA method, more recently developed antibodies are used. This newer ELISA method has been used reliably by other investigators [1–3]. As indicated, this method has an \( R \) value of 0.97, which translates to \( R^2 \) of 0.94 when compared with the DADE B latex-assisted turbidimetry method and \( R^2 \) of 0.92 with the DAKO ELISA method.

In our judgment, this leaves little margin for error. We agree that improved techniques will give significantly explain the marked limitation of GFR estimators to predict GFR. We agree that improved techniques will give significantly explain the marked limitation of GFR estimators to predict GFR.

Looking at the results of our paper, and those presented in the literature, we certainly find significant difficulty to understand the limitations of this method. This is likely due to the enhanced sensitivity of this ELISA technique.

Conflict of interest statement. None declared.

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Advance Access publication 19 October 2007

**Glucose-added dialysis fluid prevents asymptomatic hypoglycaemia in regular haemodialysis**

Sir,

It is with much interest that I read the article on haemodialysis-associated hypoglycaemia by Jayme E. Burmeister et al., published in the April issue of NDT [1]. The authors reported that arterial glucose concentrations dropped to 21 mg/dL (1.2 mmol/L) in one diabetic patient and to 60 mg/dL (3.3 mmol/L) in another non-diabetic patient, without clinical symptoms when using glucose-free dialysate. Arterial blood samples, however, were drawn from the extracorporeal blood line.

Given the absence of symptoms in spite of severe extracorporeal hypoglycaemia, I would like to direct attention to recirculation, which may have led to such low concentrations [2,3]. The effects of recirculation have been studied for urea kinetics in much detail; however, these considerations extend to other solutes with high extracorporeal gradients such as glucose, especially when using a glucose-free dialysate. The considerations also extend to arterial and venous blood temperatures, which can therefore be used to measure recirculation [4].

The following equation can be used for computing systemic arterial (\( c_a \)) from arterial line concentrations (\( c_s \)) and overall recirculation (\( R \), given as a fraction):

\[
f_R = \frac{c_a}{c_s} = \frac{Q_b (1 - R)}{Q_b (1 - R) + K_d R}
\]

where \( Q_b \) and \( K_d \) refer to extracorporeal blood flow and dialyzer clearance, respectively. For example, when blood lines are inadvertently switched, which occurs more frequently than anticipated, recirculation may reach values in the range of \( R = 0.5 \). Assuming realistic values for \( Q_b = 0.3 \) and \( K_d = 0.15 \) L/min, respectively, it follows from equation (1) that \( f_R = 0.67 \). Thus, the arterial line concentration (\( c_s = 21 \) mg/dL) is erroneously low and represents only 67% of the systemic concentration (\( c_s = 31 \) mg/dL). However, blood lines do not have to be switched for recirculation to occur. In a malfunctioning access, \( R \) may be higher than 0.5, even with correct placement of blood lines, and the value of \( f_R \) may become even smaller. The true systemic concentration will therefore be underestimated if not accounting for recirculation.

The opposite effect may occur when a normo-glycaemic patient is dialyzed with a high glucose dialysate, e.g. at a concentration of 200 mg/dL. In this case, recirculation will lead to false high arterial line concentrations, and the true systemic concentration will be overestimated if not accounting for recirculation.

Therefore, when studying systemic effects of solutes readily exchanged with the dialysate, it is also necessary to measure recirculation. Since effects are caused both by access and cardiopulmonary recirculation [5], systems capable of measuring both components of recirculation will be helpful to determine the correct systemic concentration. We have successfully used such a system in our studies, using temperature as an indicator and automatically measuring recirculation by changing the dialysate temperature for a short period of time [6]. Because the indicator dissipates, measurements do not interfere with the treatment and can be repeated as often as desired [7].

**Transparency declaration**

The author has worked with the blood temperature monitor (BTM) to measure recirculation and has received financial
as well as material support from the manufacturer of the BTM, Fresenius Medical Care, Germany.

Conflict of interest statement. None declared.

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Reply

Sir,

We thank Dr Schneditz for his interest in our study. In his comments, the hypothesis that low blood glucose levels without symptoms could not be real, but attributable to recirculation of venous line blood in the vascular access when using glucose-free dialysate, is interesting and apposite.

Hypoglycaemia without symptoms has been previously described in diabetic patients, in circumstances other than dialysis [1] and during regular haemodialysis in diabetics and non-diabetics [2–4]; some mechanisms have been implicated in the explanation for the absence of symptoms [5–7]. This was, in fact, the motivation and the first purpose of our study: to evaluate the frequency of this phenomenon, and suggest a way to prevent it.

In our study, the possibility of recirculation in the vascular access was not directly verified, but there is some evidence against its presence: the URR of all patients enrolled in the study was regularly under 0.30 in the previous months and in the study (an indication of adequate dialysis dose, not achievable with recirculation in the vascular access); hypoglycaemia was repeatedly not observed in all blood samples of the same patient, as would be expected in the presence of significant recirculation (in this case, certainly present in the whole session of the dialysis).

Furthermore, other studies have demonstrated significant reduction of glucose levels in the blood running out of the dialyzer when using glucose-free dialysate [8], and we and others [2,3,9] found a significant loss of glucose in the dialysate leaving the dialyzer, all pointing to the possibility of a ‘real’ occurrence of systemic hypoglycaemia.

Finally, we agree that, in such a case, blood samples obtained from the peripheral circulation must be preferred, to avoid this possible kind of bias.

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Is PTH a risk factor for cardiovascular calcifications in haemodialysis?

Sir,

We read with interest the article in NDT by Coen et al. [1], on the association between serum intact parathyroid