CORRELATION BETWEEN SERUM SODIUM CONCENTRATION AND PLASMA CONDUCTIVITY AT DIFFERENT STAGES OF THE HEMODIALYSIS SESSION

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INTRODUCTION

Monitoring changes in the body sodium pool during hemodialysis (HD) sessions would be very useful and clinically relevant. Because a continuous and non-invasive measurement of sodium concentration in blood during HD is not currently possible, kinetic models for plasma conductivity (C_{pl}) estimation are used, based on the relationship between conductivity and ionic concentrations in plasma [1].

STUDY AIM

The aim of the study was to investigate the correlation between the patient's serum sodium concentration ([Na]) and C_{pl} estimated by the Diascan biosensor, for the purpose of a non-invasive estimation of [Na], at different stages during the HD session.

METHODS

24 dialysis patients were selected and a total of 152 sessions were studied.

Arterial blood samples were taken for the measurement of [Na] by blood gas analysis (direct potentiometry with an ion-selective electrode). Within 10 minutes after every sampling, C_{pl} was estimated by the Diascan biosensor and recorded by the dialysis machine. The timing of the blood sampling was 5', 35', 95', 155' from session start (SS) and 25' before session end (SE).

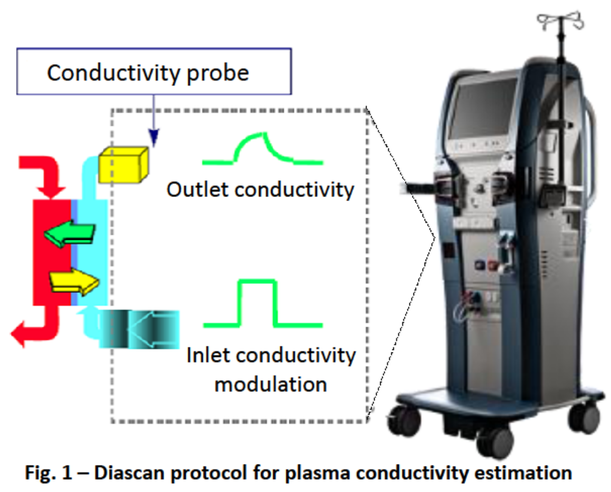

Fig. 1 – Diascan protocol for plasma conductivity estimation

Recorded data was processed as follows: linear regression between [Na] and C_{pl} was calculated with the least-squares method for the whole dataset at each sampling time. Correlation coefficients were also calculated. The 95% confidence interval was calculated on the difference between the measured [Na] and the value estimated by linear regression.

RESULTS

The correlation between [Na] and C_{pl} for the whole dataset was R=0.54 (p<0.001). The time-specific correlations are reported in Fig. 2. All regression coefficients are significant with p<0.001 except for SE (p=0.003). Since the correlation of SE data was considerably lower than the correlation at any other time during the session, the global correlation was recalculated excluding data from the last measurement, resulting in a value of R=0.60 (p<0.001, Fig. 2, bottom right).
The 95% confidence interval of the difference between measured and estimated [Na] (calculated using the linear regression parameters estimated from the whole dataset) was 5 mmol/l.

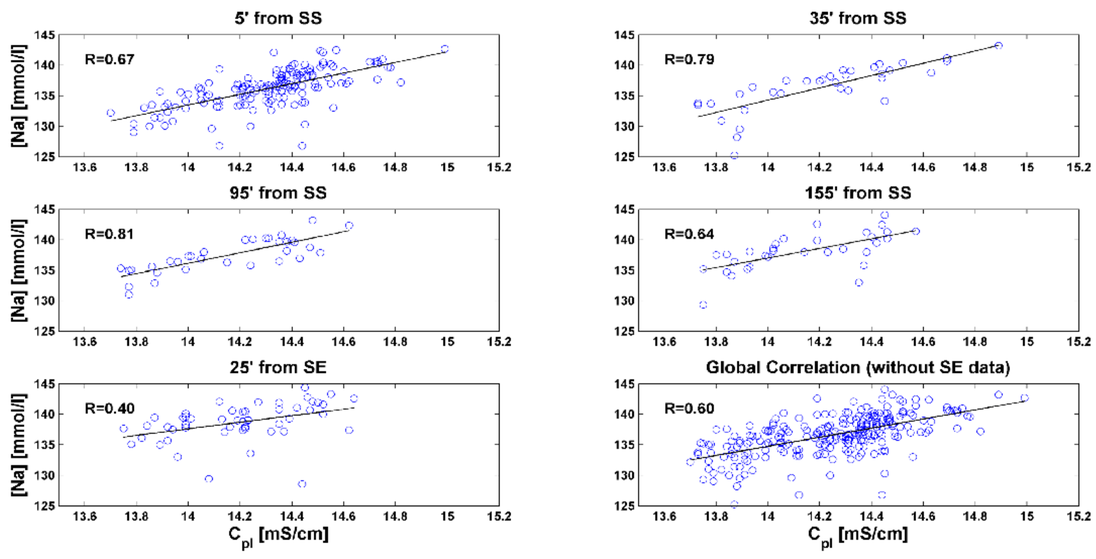

Fig. 2 – Correlation between serum sodium concentration ([Na]) and plasma conductivity (C_{pl}) at different times and global correlation

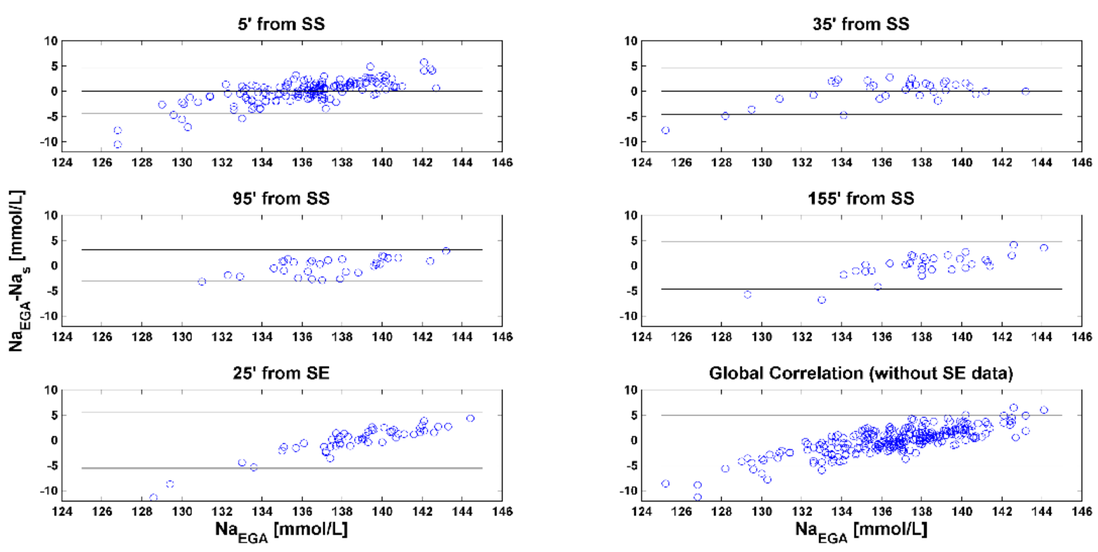

Fig. 3 – Confidence intervals for the difference between measured and estimated serum sodium concentration ([Na]) at different times and global correlation

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CONCLUSIONS

Our results show that the global correlation between [Na] and C_{pl} is comparable with that reported in previous studies [2].

The evaluation of correlation at different times during the session shows that this relationship is valid for the whole treatment time, except at SE. The reason for this lower correlation is not clear, but it could be related to the variability in measurement timing due to the variability in session duration.

Since correlation is maintained up to SE, Diascan measurements could be used for non-invasive [Na] estimation. Moreover, estimation at SS (where correlation is high) could also be used for individualization of dialysis prescription.

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