

# ACCURATE ESTIMATION OF DELIVERED DIALYSIS DOSE BY ON-LINE ULTRA VIOLET ABSORBANCE IN THE SPENT DIALYSATE

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## Introduction

The dialysis dose has been reported to have a great significance for the outcome of the dialysis treatment. A new technique for on-line monitoring of solutes in the spent dialysate utilising the UV- absorbance has been established, enabling one to follow a single haemodialysis session continuously and monitor deviations in dialysis efficiency. A good correlation between UV-absorbance and urea enables determination of Kt/V for urea.

**The aim** of this study was to compare equilibrated urea Kt/V from on-line UV-absorbance measurements (eKt/Va), by a new algorithm developed to calculate eKt/V using on-line UV-absorbance (eKt/Vn), and the urea eKt/V obtained from the blood samples according to the rate adjustment method (eKt/Vb).

## Subjects and Methods

This study was performed after approval of the Ethics Committee at the Department of Nephrology, University Hospital of Linköping, Sweden. An informed consent was obtained from all participating patients.

8 uremic patients, 4 females and 4 males, mean age 63.5years, range 20-81 years, on chronic thrice-weekly haemodialysis were included in the study during 49 haemodialysis treatments.

The clinical set-up utilised a spectrophotometer (UVIKON 943, Kontron, Italy) connected to the fluid outlet of the dialysis machine with all spent dialysate passing through an optical cuvette (Figure 1). The spectrophotometer measured UV-light absorption at wavelength 285 nm.

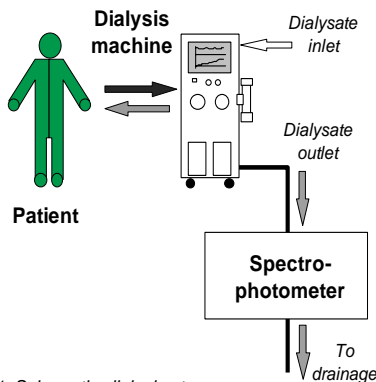


Figure 1. Schematic clinical set-up.

The new algorithm to calculate eKt/V was obtained using regression analysis including several dependent parameters like eKt/V from on-line UV-absorbance (Figure 2), dialysis length, blood flow rate, dialyzer's urea clearance in-vitro, patient's dry body weight, and indication for diabetes as a dummy variable.

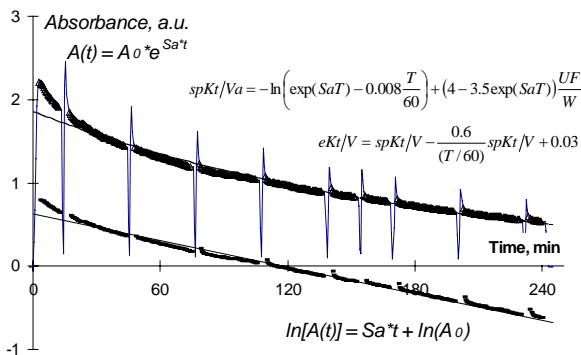


Figure 2. eKt/V calculation principle from UV-absorbance.

eKt/V from the three methods was finally compared regarding mean values and SD. Random error was calculated for different methods as SD over the sessions Accuracy. For a single session Accuracy was in percentage as

$$\text{Accuracy} = 100 * (\text{eKt/Vb} - \text{eKt/Va}) / \text{eKt/Vb}$$

when calculated for eKt/Va. eKt/Vn was used instead of eKt/Va when Accuracy was calculated for the new algorithm. Students t-test (two tailed) and Levene Test of Homogeneity of Variances were used to compare means for different methods and SD values respectively.

## Results

The mean value of eKt/V obtained with UV-absorbance (eKt/Va) was  $1.19 \pm 0.26$ , using the new algorithm (eKt/Vn) was  $1.30 \pm 0.21$ , and eKt/V from blood-urea (eKt/Vb)  $1.30 \pm 0.22$  (N = 49 for all methods) (Figure 3). The mean values of eKt/Va and eKt/Vb were statistically different ( $P < 0.05$ ). This difference or systematic error can be eliminated by adjusting the mean eKt/Va value. eKt/Vn and eKt/Vb were not statistically different ( $P \geq 0.71$ ). The SD-s were not significantly different ( $P \geq 0.64$ ) for any methods.

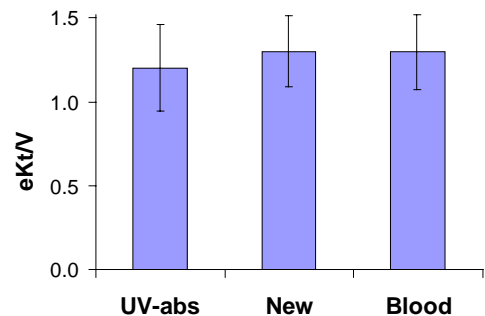


Figure 3. The mean value  $\pm$  SD of eKt/V obtained with UV-absorbance (UV-abs), using the new algorithm (New), and eKt/V from blood-urea (Blood)

The random error using eKt/Vb as a reference was 10.05% for eKt/Va and 5.42% for eKt/Vn (Figure 4). The random errors were significantly different ( $P < 0.05$ ) indicating that the new algorithm enables more accurate eKt/V estimation.

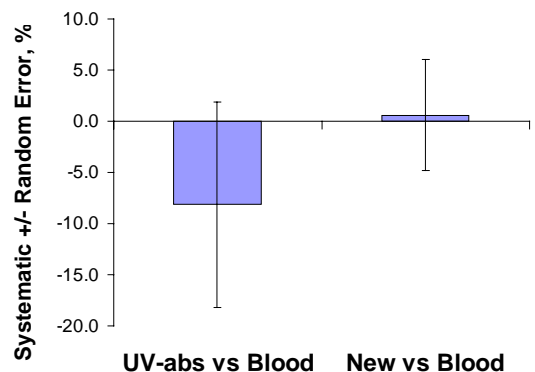


Figure 4. The systematic and random errors in respect of blood eKt/V for eKt/Va (UV-abs vs Blood) and for eKt/Vn (New vs Blood).

## Conclusion

The presented results show the possibility to estimate urea eKt/V with a high accuracy utilising the new algorithm based on on-line UV-absorption measurements in the spent dialysate.

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