

# KSN 2016 Abstract Submission

## *Dialysis*

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**Prediction of Potassium on ECG of Maintenance Hemodialysis Patients with the Aid of Artificial Neural Network**

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**Background:** To investigate the variability of serum potassium on ECG in hemodialysis patient and evaluate the efficiency of Artificial Neural Network (ANN).

**Methods:** We conducted a prospective clinical trial to assess the efficiency of artificial neural network compared to the traditional analysis method. Primary outcome was the variability of serum potassium during hemodialysis and corrected QT. We enrolled 146 under regular hemodialysis at least 3 months with written informed consent. The clinical parameters were collected before dialysis, including demographic information, biochemical data and eKt/V. During dialysis on each hour point, we collected the dynamic change of data, including serum level of electrolyte, blood pressure and ECG parameters. With the aid of Back Propagation artificial neural network (BP-ANN) and SPSS software, we analyzed the influence of serum potassium levels and variability on ECG parameter.

**Results:** According to the predialysis serum potassium levels, all patients were divided into three groups. The variability of serum potassium in hyperkalemia group was higher than the other two groups ( $19.93 \pm 3.06$  vs.  $18.29 \pm 5.48$  vs.  $14.83 \pm 4.98$ ,  $P=0.000$ ). There was no significant difference of the total amount of calories and protein, dietary intake of potassium among the groups. There were significant differences in corrected QT interval between three groups ( $461.80 \pm 26.24$  ms vs.  $449.99 \pm 23.75$  vs.  $450.95 \pm 17.12$  ms,  $P=0.02$ ). The attack of arrhythmia in hyperkalemia group was more frequently than the other two groups (1.13 vs. 0.43). During dialysis, the level of potassium decreased from  $4.85 \pm 0.56$  mmol/L to  $3.25 \pm 0.39$  mmol/L. The change of corrected QT interval declined from  $454.49 \pm 24.45$  ms to  $415.97 \pm 36.82$  ms in the third hour, and increased rapidly to  $457.31 \pm 50.58$  ms at the end treatment, which was nonlinear. With the help of artificial neural network method, we made NAR nonlinear autoregressive model and predicted the level of potassium using time series analysis. MSE was  $0.226 \pm 0.139$ , whose accuracy indicated that the model was reliable and accurate to predict serum potassium levels of each individual. We established a single hidden layer BP-ANN to analyze the influence of serum potassium levels and variability on the QT intervals, results showed that the model including variation of potassium, potassium change amplitude and baseline QT interval was more accurate than the others (MSE: 225.4820; MAPE\_QT4: 2.6877%).

**Conclusion:** The dynamic changes of corrected QT intervals is nonlinear in dialysis. The patients with hyperkalemia suffered highly variability during dialysis, who had more attack of arrhythmia during the period of 2-4h dialysis. ANN might predict the trend of serum potassium of each individual. The model including

variation of potassium, potassium change amplitude and baseline QT interval was more accurate to analysis the change of QT interval.

**Keywords:** hemodialysis; hyperkalemia; QT; Artificial Neural Network