Connecting Medical Informatics and Bio-Informatics
R. Engelbrecht et al. (Eds.)
ENMI, 2005

1116

Applying a Coactive Neuro-Fuzzy Inference System to Predict Intact Parathyroid Hormone Level in Hemodialysis Patients

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Measuring plasma intact parathyroid hormone concentration (iPTH) is crucial for the management of renal osteodystrophy in hemodialysis (HD) patients. Although frequent measurements of iPTH are necessary to avoid inadequate prescription of vitamin D analogues, it is not cost-effective in most of the hospitals. For this purpose, we developed a coactive neuro-fuzzy inference system (CANFIS) to predict iPTH in HD patients. The CANFIS was constructed with predictors (age, plasma albumin, calcium, inorganic phosphorus, alkaline phosphatase concentrations, and calcium-phosphorus product) from training set (n = 121) selected from a cohort of chronic HD patients at Hospital A. iPTH measured by radioimmunoassay (iPTH-RIAA) was the outcome variable. After training, the CANFIS was tested in an external validation sample (n = 26) at Hospital B. The comparisons between iPTH measured by radioimmunoassay at Hospital B (iPTH-RIAB) and predicted iPTH by the CANFIS (iPTH-CANFIS) were evaluated. The iPTH-RIAB and iPTH-CANFIS were not statistically different (108.96 ± 22.52 pg/ml vs. 136.45 ± 15.12 pg/ml, p = 0.08) by using Wilcoxon test. The Pearson's correlation coefficient was 0.77 (p < 0.0001) and mean error of the Bland-Altman comparison was 0.76, which represented significant correlation and lesser bias. The relationship between iPTH-RIAB and iPTH-CANFIS by Passing and Bablok regression was iPTH-CANFIS = $67.45 + 0.69 \times$ iPTH-RIAB (95% confidence interval for intercept 13.62 to 92.99 and for slope 0.38 to 1.38), indicating that both methods are interchangeable without significant deviation (p > 0.10). The good performance of CANFIS to predict iPTH in HD patients was proved by external validation and CANFIS is helpful for the management of renal osteodystrophy.

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