

# <sup>1</sup>H NMR-based metabolomics of plasma and dialysate from hemodialysis patients

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<sup>1</sup>H NMR observation of plasma and dialysate from hemodialysis (HD) patients was subjected for profiling of metabolites. Our previous work on <sup>1</sup>H NMR metabolomics of plasma from HD patients has revealed lactate increment after treatment.<sup>1)</sup> Lactate increment suggested impaired energy metabolisms in HD patients. Blood sample collection is limited in HD patients because of anemia. Then we used dialysate, which is non-invasive for patients and without limitations of collection. In analytical aspect, plasma samples were less reproducible because plasma is heterogeneous mixture of proteins, lipids, organic acids and other small metabolites. On the other hand, dialysate has good reproducibility for its composition of only small metabolites, and also ensures adequate quantification of metabolites by <sup>1</sup>H NMR. We have also verified dialysate as a surrogate for blood in measuring small metabolites during HD, by quantitative <sup>1</sup>H NMR.<sup>2)</sup>

In this study, 600 dialysate samples from 20 patients were collected in time course during HD sessions, and measured 1D single-pulse spectra by 600 MHz NMR (ECA, JEOL Ltd.) spectroscopy. The main metabolites were quantified by their peak integrations on the spectra. These concentrations in time course revealed to have unique pattern to patient in every HD session. The finding has potential information for future personalized therapy.

In all of patients, creatinine exhibited monotonous decay and valine showed plateau toward the end of the session. While patients derived from chronic-glomerular-nephritis exhibited significant increment of lactate together with alanine and pyruvate at the middle during HD sessions, which indicated rather amount of productions from the body. HD treatments rapidly remove electrolytes, water, and small molecules including bioactive necessities and nutrients as well as uremic toxins from the blood. As the response to the HD stress, compensative reaction to maintain homeostasis may occur followed by their productions into blood. The increment of lactate, pyruvate and alanine suggested accelerated glycolysis and/or disturbances of metabolic pathway at the entrance to TCA cycle.

We will discuss the relation between metabolic profile in each patient and one's etiology, and the possible revisions of HD therapies.

- 1) Fujiwara M. *et al* Pattern recognition analysis for <sup>1</sup>H NMR spectra of plasma from hemodialysis patients. *Anal. Bioanal. Chem.* 2009, 394: 1655-1660
- 2) Ando I, Fujiwara M. *et al*, <sup>1</sup>H NMR Spectroscopic Quantification of Plasma Metabolites in Dialysate during Hemodialysis *Magn.Res. Med.Sci.* 2013, 12, No.2, 129-135