

Propylene Glycol is Essential in the LCModel basis set for Paediatric Brain ¹H-MRS

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Introduction

It is not uncommon for newborn infants to be treated with a drug preparation containing propylene glycol. Propylene glycol is a pharmaceutical solvent for preparations including anticonvulsants, sedatives, and vitamin infusions. Using ¹H-MRS, propylene glycol shows up as a doublet centered at 1.15 ppm, downfield from the lactate doublet centered at 1.30 ppm. Because of its location and size, this doublet can cause problems with LCModel [1] quantitation of lactate unless propylene glycol is included in the basis set.

Subjects and Methods

Scanning was done with a GE Signa 1.5 T MRI scanner (General Electric, Milwaukee, WI) using a single voxel PRESS sequence (TE = 144, TR = 1500, 256 NEX, 6-8mL). 35 scans were selected which, on visual inspection, had a poor spectral model fit at 1.15 ppm. An additional 10 scans with acceptable residual errors in this spectral region were selected at random for comparison. Data was analyzed using LCModel Version 6.0-1 with the standard basis set (SBS) provided. A second analysis of each data set was done using a new basis set which consisted of the SBS plus propylene glycol (SBS+PG). The propylene glycol basis set was developed following scanning of a phantom containing 46.6 mM propylene glycol in the "Standard Solvent" described in the LCModel manual (<http://www.s-provencher.com/pages/lcmodel.shtml>).

Results

The 10 scans selected at random showed no significant difference between analyses done using SBS compared to that with SBS+PG. In addition these scans did not exhibit a statistically significant contribution of propylene glycol to the overall spectral fit (SD > 600%).

The 35 scans with abnormalities had an average propylene glycol concentration of 3.8±2.4 IU (measured in institutional units) with standard deviation calculated by LCModel of 16.8±8.1%. The signal to noise ratio, as calculated by LCModel, was improved by an average of 1.9±0.9 per scan. In 18 out of 35 cases the concentration of lactate determined by the SBS+PG fell outside the range determined by the SBS analysis.

	Lactate Concentration	%SD
Using standard basis set	3.6 ± 4.4 IU	195.8 ± 371.0%
Using standard basis set plus propylene glycol	3.5 ± 2.2 IU	23.3 ± 9.6%

Table 1. Comparison of average concentration and standard deviation values of Lactate between basis sets.

Discussion/Conclusions

As LCModel functions by solving a linear combination of fits of all metabolites, addition of another metabolite affects the global fit. Here, with the inclusion of propylene glycol in the basis set, there does not appear to be any detracting effects. In addition, the quantitation of lactate has been dramatically improved when propylene glycol is present in the brain (Table 1). The accurate and proper identification of lactate is clinically very important. Thus for the better interpretation of paediatric ¹H-MRS results, we suggest the inclusion of propylene glycol in the basis set when using LCModel.

[1] Provencher (1993) *MRM* 30:672-679.