

# THE ASSESSMENTS OF THE NEONATAL BRAIN DEVELOPMENT BY 2D 1H-MRS IN 3.0 TESLA

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## Introduction

Proton magnetic resonance spectroscopy (<sup>1</sup>H-MRS) is an important method to assess the neonatal brain development and injury, which most often precedes other functional and anatomic changes [1]. A detailed assessment of the normal distribution of metabolite levels in the developing brain is important to improve our understanding of brain biochemical development and to establish a normal reference for determining abnormal metabolism in pathologic states [2-4]. However, there are no the normative MR spectroscopy values that is universally acknowledged. In this study, we investigate the differences of NAA/Cho ratio, NAA/Cr ratio and Cho/Cr ratio in special regions between premature neonates and term neonates, and the correlation between metabolite ratios and postmenstrual ages (PMA) to assess normal metabolite levels for the neonatal brains using 2D MR spectroscopy imaging techniques in 3.0 T magnetic machine.

## Methods

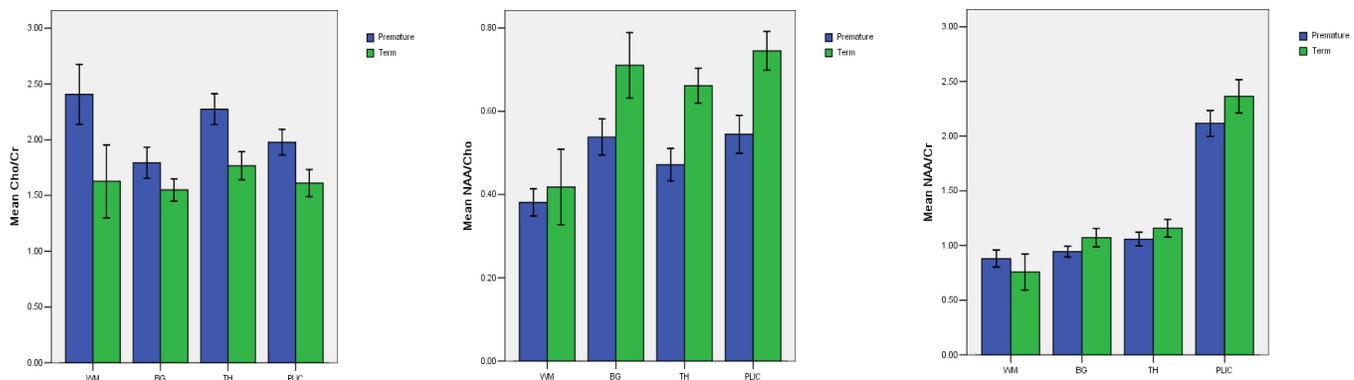
Eighteen premature neonates (PMA at MR scan: 35.1±1.2 weeks) and eighteen term neonates (PMA at MR scan: 39.9±1.6 weeks) with normal MR appearance were collected in this study. The MR examination was performed on a GE Signa HDxt 3.0T MR scanner using 8ch head coil. A multivoxel 2D MR spectroscopy scan was performed using the point-resolved spectroscopy sequence (PRESS). The acquisition parameters are 144ms/1000ms (TE/TR), 10mm thickness, 24cm×24cm FOV, 18cm×18cm acquisition matrix, 1 excitation and an acquisition time of 328s. ROIs were drawn bilaterally on T2 vertical axial images (5mm slice thickness, no gap) for basal ganglia (BG), thalamus (TH), white matter (WM) beside cornu anterius ventriculi lateralis and posterior limb of internal capsule (PLIC). Spectroscopy data were analyzed using function tool of GE AW 4.4 workstation and NAA/Cho ratio, NAA/Cr ratio and NAA/Cr ratio were calculated. Statistical analysis was performed in SPSS 13.0. Independent sample t test for every metabolite ratio in region was made between the premature and term neonates. The correlation and regression analysis between different metabolite ratio and PMA were also made. Two-sided P value less than 0.05 was considered statistically significant.

## Results

The metabolite ratios of NAA/Cho, NAA/Cr and Cho/Cr were statistically different between premature and term in the regions of BG, TH and PLIC (P<0.05). The mean ratios of NAA/Cho and NAA/Cr of the regions in premature were significantly lower than them in term while the mean ratio of Cho/Cr was higher. The correlations of the metabolite ratios with PMA were significant in above three regions. Regression analysis showed the linear positive correlations between PMA and NAA / Cho ratio, NAA/Cr ratio while linear negative correlations between PMA and Cho/Cr ratio. There were no significant differences of NAA/Cho ratio and NAA/Cr ratio in the region of white matter (WM) beside cornu anterius ventriculi lateralis between premature and term. There were significant differences in the metabolite ratios between anatomic regions besides NAA/Cho ratio between BG and PLIC and Cho/Cr ratio between TH and WM.

## Discussion and Conclusion

The metabolite ratios vary with both PMA and anatomic location. The NAA/Cho ratio and NAA/Cr ratio increase significantly while Cho/Cr ratio decrease significantly with PMA. This age-dependent variations demonstrate the feasibility to establish a normal baseline. NAA/Cho ratio and NAA/Cr ratio in white matter (WM) beside cornu anterius ventriculi lateralis are lower than them in the other three regions and no difference between premature and term. The significant differences between anatomic regions indicate the white matter matures later than the gray matter and demonstrate the possibility to assess the degree of the neonatal brain mature by <sup>1</sup>H-MRS. Further studies with much larger numbers at each age will be better to establish a normal baseline in clinical assessments of the neonatal brain and to determine the severity of the injury at early stage.



Graphic representation of the differences between premature and term NAA/Cho-, NAA/Cr and Cho/Cr peak area ratios for each anatomic region.

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