Diffusion-weighted MRI for differentiation of thoracoabdominal neuroblastic tumors: preliminary results

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The target audience is pediatric radiologists and pediatric surgeons.

Introduction: Diffusion-weighted (DW) magnetic resonance imaging (MRI) has demonstrated a great potential to help distinguish benign from malignant tumors. The malignant lesions have low apparent diffusion coefficients (ADC) due to higher cellularity while benign lesions show less diffusion restrictions with corresponding higher ADC. However, published articles about diffusion changes in tumors of pediatric body are very limited.[1-3] The aim of this study was to retrospectively identify ADC values of thoracoabdominal neuroblastic tumors, to determine whether measured ADC of the lesions and signal intensity on DW images allow differentiation of neuroblastoma, ganglioneuroblastoma and ganglioneuroma.

Materials and Methods: Approval for this retrospective study was obtained from the institutional ethics committee. Children with histologically proven neuroblastic tumors of thoracoabdominal body, who were examined by DW MRI were included in this study. DW MRI was performed with a *b*-value of 800s/mm^2 on a 3.0T MR scanner (Philips Medical Systems, The Netherlands) after anatomic imaging but before contrast media injection. DW images were obtained in the axial plane by using a respiratory-triggered/free breathing single-shot spin-echo sequence. The results of visual assessment on b800 images and ADC map images were compared with chi-square test. ADCs were measured for all the tumors. And ADC values of different tumors were compared with Independent Samples T Test. $P < 0.05$ was considered statistically significant.

Results: Twenty-one patients (11 girls, 10 boys) with neuroblastic tumors were enrolled in the study. Their age ranged from 5 months to 11 years with a mean age of 4 years and 9 months in the group of the ganglioneuroma and ganglioneuroblastoma, and a mean age of 2 years and 3 months in the neuroblastoma group. 13 neuroblastic tumours arose from the thoracoabdominal sympathetic nervous system (9 in the retroperitoneum, 4 in the posterior mediastinum), 8 tumors were located in the adrenal gland. The mean ADC of the 13 neuroblastomas was 0.76×10^{-3} mm^2/s (SD 0.31×10^{-3} mm^2/s, range $0.62–1.27 \times 10^{-3}$ mm^2/s), among which six cases had widespread metastasis. And the mean ADC of the 3 ganglioneuroma and 5 ganglioneuroblastoma was 1.32×10^{-3} mm^2/s (SD 0.45×10^{-3} mm^2/s, range $0.98–1.56 \times 10^{-3}$ mm^2/s). The neuroblastomas had significantly lower ADC values than the ganglioneuroma and ganglioneuroblastoma ($P < .001$). For both b800 and ADC map images, there were statistically differences on visual evaluation. All the 13 neuroblastomas had conspicuous high signal intensity whereas 5 of the ganglioneuroma and ganglioneuroblastoma had slight high signal intensities or isointensities on b800 images ($P < .01$). On ADC map images, all the neuroblastomas were hypointense and 5 of other neuroblastic tumors were mild hypointense or isointense ($P < .01$).

Discussion and Conclusion: The study shows that there is a significant difference of the ADC of neuroblastoma compared to the ADC of ganglioneuroma and ganglioneuroblastoma, a remarkable difference of DW signal intensity between the two groups as well. The preliminary results suggest that the DW imaging could reliably differentiate neuroblastoma from ganglioneuroma/ganglioneuroblastoma, and as a quantitative objective measure, ADC could potentially aid in determining the diagnosis and reveal therapeutic response.

References

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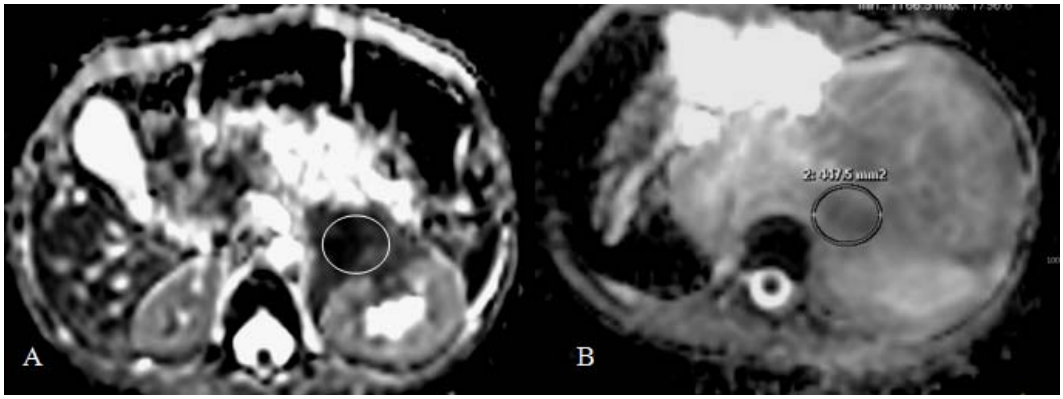

Fig. A: The neuroblastoma in the left retroperitoneum is hypointense on ADC map image, ADC value is 0.81×10^{-3} mm^2/s (see ROI). Fig. B: The ganglioneuroma in the posterior mediastinum is slight hypointense, ADC value is 1.44×10^{-3} mm^2/s (see ROI).