Microcirculation in Pituitary Dwarfism: Time to Peak Analysis by Contrast-Enhanced Dynamic MR Imaging

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Background

The pituitary gland is a complex neuroendocrine organ involved in the control of a variety of homeostatic mechanisms. Subtleties in the internal anatomy of this gland such as specializations in its regional microcirculation are now becoming appreciated. Pituitary dwarfism may lead to vasculature changes of the gland that may cause a microcirculation deficiency(1). To investigate the changes in the pituitary microcirculation in dwarfism patients, we performed dynamic MR imaging to measure the delayed contrast enhancement in patients(2). The perfusion deficiency was also evaluated spatially to correlate with the growth hormone deficiency.

Material and methods

Fifteen patients with clinically proved isolated pituitary dwarfism and fifteen control subjects were enrolled in this MR study. MR scans were performed on a Siemens 1.5 T Magnetom Vision+ system with circular-polarized head coil. In addition to traditional T1- and T2-weighted imaging, contrast enhanced dynamic MR studies were performed for all subjects. Three contiguous coronal slices over anterior pituitary lobe were obtained with T1 fast spin echo sequence. Twelve serial sequences were repeated per 20 second after rapid manual injection (2mL/s) of Magnevist (0.1 mmol/kg). Nine small regions (1- to 2-mm^2) were located for analysis as shown in Fig.1. The time to peak (TTP) of contrast enhancement was then measured for each region of interest (ROI). The TTP difference between both groups was also measured. A delayed enhancement was defined as the TTP difference between both groups relative to the TTP of normal subjects.

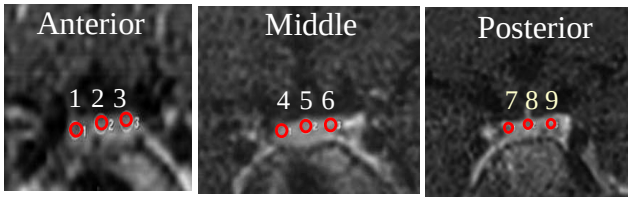

Figure 1. ROIs were drawn on the median and bilateral paramedian of anterior, middle and posterior portion of anterior pituitary lobe (labeled from 1 to 9) in each dynamic phase to calculate the TTP enhancement.

Results

Averaged TTP in each ROI are shown in table 1 for both control and dwarfism groups. The TTP in center (median) area was faster than in bilateral paramedian areas for both groups. In comparison with control subjects, dwarfism patients had averaged 83% to 126% delayed enhancement in median ROIs (ROIs 2, 5, 8)and 32% to 92% delayed in paramedian ROIs (ROIs 1, 3, 4, 6, 7, 9).

Position	Anterior portion			Middle portion			Posterior portion		
ROI	1	2	3	4	5	6	7	8	9
Normal TTP	54	33	51	62	31	62	54	26	51
Dwarfism TTP	93	72	98	99	57	82	93	59	82
Delayed enhancement	72%	118%	92%	59%	83%	32%	72%	126%	60%

Table 1. Averaged TTP enhancement results for both control and dwarfism groups

Discussion

In the present study, we demonstrated that the microcirculation deficiency is existent in dwarfism patients. It can be clearly distinguished from normal subjects by using TTP analysis derived from dynamic contrast enhanced MRI. The delayed TTP enhancement found in all three contiguous slices over anterior pituitary lobe implied that vasculature in pituitary dwarfism may be changed not only in the growth hormone secretion area but in the overall anterior lobe of pituitary gland. Therefore, growth hormone deficiency may not be correlated with spatial distribution of impaired microcirculation. With multi-slice fast spin echo MR imaging, dynamic contrast enhanced technique can be applied to investigate the microcirculation deficiency of pituitary gland spatially and temporally.

Reference

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