Dynamic contrast-enhanced MR imaging of the stimulated pituitary gland

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Introduction

Apoplexy due to infarction and /or hemorrhage is a frequent complication of pituitary adenoma, occurring either spontaneously or precipitated by several factors, among them pituitary function test with hypothalamic releasing hormones [1,2]. The mechanism by which releasing hormones cause pituitary apoplexy is unclear. It has been proposed that increase in pituitary size and /or alteration in blood flow could be responsible. The aim of this study was to explore the effects of intravenous administration of hypothalamic release hormones on pituitary size and hemodynamics in healthy subjects.

Materials and Methods

Ten young (aged 27.3 +/- 5.6 years), healthy subjects (5 male, 5 female) were included in the study. For each subject 2 study days were scheduled with intervals of 7 days. On study day 1, MRI scans were performed under basal conditions. On study day 2, MRI scans were performed 20 min. after i.v. injection of hypothalamic releasing hormones - the time point when the pituitary would be expected to be most active as judged by peak concentrations of most pituitary hormones. TSH, ACTH and GH reach their peak values in the circulation after 20-30 min, Prolactin earlier (10-20 min.) and FSH and LH later (30-45 min.) [3].

MR examinations of the pituitary were performed on a 1.5 T MR unit with a gradient strength of 23mT/m. Using a circularly polarized head coil three localizer sequences in axial, coronal and sagittal plane were obtained to provide reproducible imaging planes for second intraindividual examination. Based on this localizer sequences, the pituitary was examined on the coronal plane pre- and postcontrast and in the sagittal plane postcontrast. The following sequences were applied: a standard T1-weighted spin echo sequence (284x512 matrix, Slice thickness: 2mm) before and after i.v. administration of a double dose (0.2mmol/kg body weight) of gadolinium-DTPA. Immediately after i.v administration of contrast agent, a dynamic contrast study was performed using a standard T1-weighted 2D GRE sequence. Each time vs. signal intensity curve generated by the scanner software was converted into the related enhancement curve according to the equation: $y(t) = (S_t - S_0)/ S_0 \times 100\%$ where $y(t)$ enhancement at time point t, S_0 the signal intensity of the first time point (baseline) and S_t are signal intensities taken from subsequent images acquired every 20s. For basal and stimulated pituitary height, width and length of the hypophysis, and the product of the three parameters (as a surrogate for pituitary volume) were measured [3]. Basal and stimulated values of pituitary measures and basal and peak hormone levels were compared using Wilcoxon rank sum test. For each enhancement curve peak value (y_{max}) and peak time (time to reach the peak t_{max}) were determined. Mean upslopes k were calculated for all enhancement curves according to the equation: $k = y_{max}/ t_{max}$. The obtained basal and stimulated values were compared using linear regression analysis and Wilcoxon`s rank sum test. $P<0.05$ was considered statistically significant.

Results

Pituitary height was <0.9 cm for all subjects in both basal and stimulated conditions. None of the measured parameters (pituitary height, length and width) was significantly different in the stimulated vs. basal pituitary, nor was the product of the three parameters.

For Gadolinium-DTPA- enhancement peak values were 124+/- 43 and 130 +/- 71, respectively (R^2 =0.852, P=0.001). They were reached after 47.5 +/- 15 (basal) and 37.5 +/- 10 s (stimulated), respectively (R^2 =0.223, P=0.24). P values for the differences were not significant for both parameters. Mean upslopes k were significantly steeper in stimulated than in basal conditions (3.51 +/- 1.66 vs. 2.63 +/- 1.24, P=0.017).

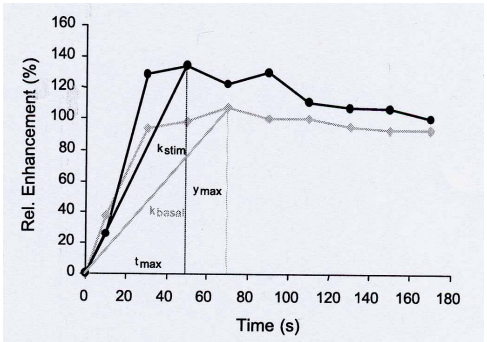

Fig. 2. Example of individual enhancement curves in basal (♦) and stimulated (●) conditions with peak values (y_{max}), peak times (t_{max}) and mean upslopes under basal (k_{basal}) and stimulated (k_{stim}) conditions.

Discussion and Conclusion

In summary, different activity states of the pituitary gland were studied for the first time by contrast-enhanced dynamic MRI with high reproducibility. It has been shown that pituitary glands of healthy subjects do not increase in size in response to i.v administration of hypothalamic releasing hormones, whereas pituitary blood flow and/or vessel permeability is increased upon stimulation.

References:

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