Optimizing MR acquisition time for dynamic pituitary gland evaluation utilizing GRASP

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INTRODUCTION: Dynamic post-contrast fast-spin echo T1W sequence remains the gold standard to evaluate the pituitary gland. Such dynamic temporal evaluation is necessary to optimally evaluate microadenoma, the most common indication to evaluate the pituitary gland[1]. The acquisition time for this sequence varies among different institutions ranging from 150 seconds to 180 seconds[2-3].
Radial VIBE with GRASP technique allows adequate evaluation for structural perfusion providing excellent temporal information with high spatial resolution[4-5].
The purpose of our study was to evaluate the signal-time curves obtained utilizing Radial VIBE with GRASP technique to optimize the acquisition time for dynamic pituitary gland evaluation.

METHODS: A retrospective HIPAA compliant study was performed in 20 patients with known microadenomas. All patients were evaluated on a 3 T (Siemens MAGNETOM Trio/Skyra). GRASP data was acquired during the administration of 0.01 mmol/kg of gadolinium-based contrast at 3 mL/second (20 sec after initiation). The following acquisition parameters were used: 0.7 mm in-plane resolution and 1 mm slice thickness, 32 slices, 180 mm FOV, FA 9.5°, BW 391 Hz/pixel, TE/TR=2.4/6.4 ms, 256 pixel base resolution, 944 spokes, and 164 sec acquisition time. ROI-based signal-time curves (STCs) were generated using the OLEA Sphere 2.2 software from the normal appearing anterior pituitary gland, and the microadenoma (Fig.1). Specifically, peak enhancement values were evaluated from the anterior pituitary gland and the microadenoma every 10 seconds beginning at 60 seconds (T1) following contrast administration, for a total time period of 140 seconds (T9). For each time T > 1, the mean, standard deviation (SD), median, maximum and the lower and upper limits of a 95% confidence interval of the mean for the percentage change in the peak enhancement was estimated from time T-1 to time T.

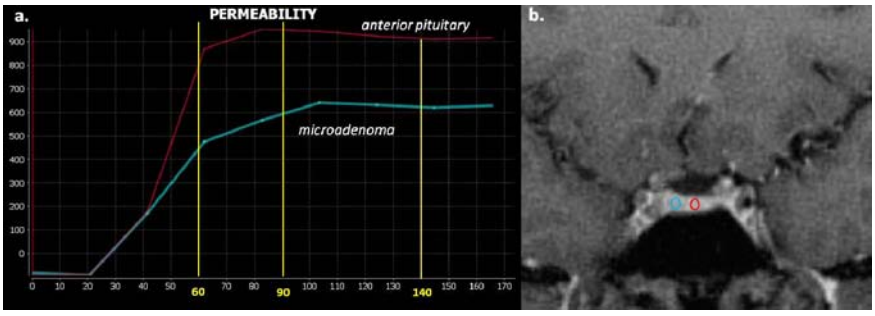

Fig.1 Signal-time curves (a.) were derived from ROIs applied to normal-appearing anterior pituitary gland (red) and microadenoma (light blue) demonstrated on GRASP images (b.).

RESULTS: The mean peak enhancement for the anterior pituitary gland was reached at T = 80 sec. (±19 sec.). There was no significant change in the peak enhancement values for the anterior pituitary gland after time T4 (90 seconds) (Table 1). The peak enhancement values for the microadenoma measured from time T1 (60 sec) to time T4 (90 sec) consistently showed a statistically significant difference when compared to the peak enhancement values of the anterior pituitary gland at comparable times ($p < 0.001$) (Fig. 2).

DISCUSSION: To our literature knowledge, this is the first pilot study to evaluate the signal-time curves in a robust, reproducible manner to optimize the acquisition time of the dynamic contrast enhanced sequence to evaluate the pituitary gland. We demonstrate that dynamic evaluation of the pituitary gland 90 seconds following contrast administration is sufficient to adequately evaluate its perfusion characteristics, and assess for any focal differential enhancement suggestive of a microadenoma. This significantly cuts short on acquisition times of 180 - 240 seconds reported in the literature to evaluate the pituitary gland. Providing such standardized imaging time is critical in today's clinical practice allowing for appropriate utilization of magnet scanning time and achieving an optimum patient throughput without compromising patient care.

CONCLUSIONS: We successfully demonstrate that an acquisition time of 90 seconds following contrast administration is sufficient to provide adequate dynamic evaluation of the pituitary gland and microadenoma. This significantly shortens acquisition time of dynamic T1W sequences from 150 – 180 seconds as reported in the current imaging literature, allowing optimum utilization of magnet scanning time.

Time T	Mean	SD	Median	Maximum	Lower	Upper
2	9.82	9.97	5.25	30.99	5.16	14.49
3	6.11	6.65	4.52	21.69	3.00	9.23
4	2.00	2.52	1.05	8.53	0.82	3.18
5	2.17	2.55	1.18	8.98	0.97	3.36
6	1.41	0.87	1.06	2.76	1.01	1.82
7	1.38	0.87	1.04	3.82	0.98	1.79
8	0.94	0.87	0.71	3.28	0.53	1.35
9	0.57	0.33	0.62	1.30	0.42	0.73

Table 1. For each time T > 1, the mean, SD, median, maximum and the lower and upper limits of a 95% confidence interval of the mean for the percentage change in the Peak estimate from time T-1 to time T.

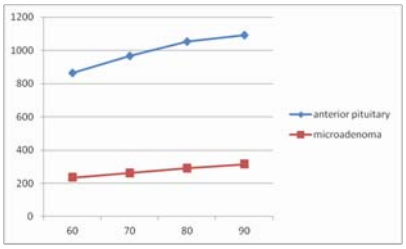

Fig.2 The peak enhancement values for the microadenoma measured from time T1(60 sec) to time T4 (90 sec) consistently showed a statistically significant difference when compared to the the anterior pituitary

References:
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