Assessment of Coronally T2-Weighted Magnetic Resonance Imaging Sequences in the Detection of Pituitary Adenomas

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Purpose

To compare coronally T2-weighted and coronally contrast enhanced T1-weighted sequences in the routine evaluation of the pituitary gland with Magnetic Resonance Imaging in patients that have clinically and laboratory suspected pituitary adenomas.
Methods and Materials

Patient Population

A total of 167 patients (125 women, 42 men; age range 7-67, mean age 35 ± 14) underwent MRI because of symptoms of the pituitary dysfunction were included in this study. An institutional review board approval and a written informed consent was obtained from each patient.

Technique

Patients were examined on a 1.5 Tesla superconducting MR system (Signa Excite II; GE Medical Systems, Milwaukee, WI). The imaging protocol included axial T2-W Fast spin-echo (FSE) sequence (TR/TE, 4600/85 ms; matrix, 320-224; field of view, 24 cm; section thickness, 5 mm; intersection gap, 2 mm; NEX, 2), coronally T2-W FSE sequence (TR/TE, 3200/102 ms; field of view, 18 cm; section thickness, 3 mm; intersection gap, 0.2 mm; matrix, 320-224; NEX, 4), coronally and sagittally T1-W spin-echo (SE) sequence (TR/TE, 500 ms/min full; field of view, 18 cm; section thickness, 3 mm; intersection gap, 0.2 mm; matrix, 320-224; NEX: 4) before and after administration of intravenous gadolinium.

Image Analyses

Three observers reviewed each images and reached a consensus without knowledge of the clinical findings. For all patients the presence, the size, and the location of the focal lesions were evaluated on the both sequences. A focal lesion was considered present when a focus of signal alteration was separable from the normal-appearing pituitary tissue on the both sequences. Lesion size was measured on both sequences. Lesions were classified as microadenomas (≤10 mm) or macroadenomas (>10 mm) according to their size. Location of the lesions were charted as right, left, middle of the gland, and diffusely enlarged gland on the both sequences. Also all patients were evaluated carefully for the ancillary signs on the both sequences. Ancillary signs include sellar floor erosion or ballonning, infundibulary deviation, convexity of the superior border of the gland, diffusely enlargement of the gland, and the invasion of the cavenous sinuses. The contrast enhanced T1-W sequences were considered as the gold standard and positive predictive value (PPV), negative predictive value (NPV), sensitivity, specificity, and diagnostic accuracy rates were estimated.
Results

In forty-six (27.5%) patients, lesions were revealed on the coronally T2-W sequences. In 66 (39.5%) patients, lesions were revealed on the coronally contrast enhanced T1-W sequences. All of the lesions identified on the coronally T2-W sequences were also identified on the coronally contrast enhanced T1-W sequences. There was no statistically significant difference on the detection of lesions between the two sequences \( (p < 0.001) \) (Fig. 1-5). The lesions of the twenty patients (11.9 %) revealed on the coronally contrast enhanced T1-W sequences were not seen on the coronally T2-W sequences (Fig 6). The patients that evaluated normal on the coronally T2-W sequences were also normal on the coronally contrast enhanced T1-W sequences (Table 1).

When we considered the coronally contrast enhanced T1-W sequences as gold standart, PPV, NPV, sensitivity, specificity, and diagnostic accuracy rates of the coronally T2-W sequences on the detection of the presence of lesions were 100%, 83%, 69%, 100%, and 88 % respectively. There was no false positive case on the coronally T2-W sequences.

There was no statistically significant difference between the two sequences on the decision of the lesion size as micro or macroadenoma \( (p < 0.001) \) (Table 2) (Fig. 1-5). The meansize of adenomas on both sequences were not significantly different \( (11.1 \pm 8.5; 10.8 \pm 8.2 \) on the coronally contrast enhanced T1-W and on the coronally T2-W sequences respectively). \( (p < 0.001) \).

The locations of the lesions are same at all patients on both sequences \( (p < 0.001) \) (Fig 1-5). There was no statistically difference between the presence of the ancillary findings \( (p < 0.001) \) (Fig 1-5).
Fig. 1: A hypointense macroadenoma with invasion of the right cavenous sinuse and infundibulic deviation could be visualized on the coronally T2-W (A) and coronally contrast enhanced T1-W (B) images of a patient.

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**Fig. 2:** A cystic macroadenoma with hyperintense signal intensity on the coronally T2-W (A) and hypointense signal intensity on the coronally contrast enhanced T1-W (B) images could be visualized. Diffuse enlargement of the gland and the invasion of the right cavenous sinuse could be demonstrated on both sequences.

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**Fig. 3:** Coronally (A) and sagittally (B) contrast enhanced T1-W and coronally T2-W (C) images show of a hypointense macroadenoma. Convexity of the right side of the gland and the invasion of the right cavenous sinuse could be demonstrated on both sequences.
**Fig. 4:** Coronally T2-W (A) and coronally contrast enhanced T1-W (B) images of a patient with microadenoma. Coronally T2-W image (A) shows a suspicious hyperintense lesion on the left side of the gland. Coronally contrast enhanced T1-W image (A) shows the lesion as a hipointensity on the left side of the gland. Infundibular deviation and diffusely enlargement of the pituitary gland could be visualized on both sequences (A, B).
Fig. 5: A microadenoma with hyperintensity on coronally T2-W (A) and hipointensity on the coronally contrast enhanced T1-W image (B) on the right side of the gland is shown. Sellar floor ballonning could be seen on both sequences.

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Fig. 6: A microadenoma with hipointensity on the coronally contrast enhanced T1-W image (A) on left side of the gland is shown (A). Coronally T2-W image (B) shows no abnormalities

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Conclusion

The most well-known conventional sequences are thin-section coronally and sagittal SE T1-W sequences before and after administration of contrast material and FSE T2-W coronally sequences. As described by Pojunas et al (1), it is believed that the T1-W sequence was superior to the T2-W sequence.

Lesions seen typically hypointense on contrast-enhanced T1-W images. The contrast enhanced T1-W images may be negative if the tumor is extremely small, the dose of gadolinium too high or the visualization window is too large (2). Also loss of lesion visibility has been noted on delayed MRI studies (3). It has been suggested that a delay in timing could lead to equalization in gland-lesion contrast and reduction in adenoma detection (4, 5). On the other hand, Bartinski and Lin (5) noted that 35% of cases enhances before the gland. They suggested that early arterial blood supply might be present (5). Also it is known that the administration of contrast material can also cause nephrogenic systemic fibrosis (NSF) and renal failure. We must avoid from the unnecessary usage of the contrast material. The costs of the contrast material also holds a lot.

Ours study showed that the coronally T2-W sequences have high specificity (%100) and low sensitivity (69%). In such a way that when the lesion was seen on the coronally T2-W sequences, the examination would be ended without administration of contrast material.

We hypothesised that the coronally T2-W images may be more able to screen the pituitary fossa and the coronally contrast enhanced T1-W images may be more able to confirm and characterise any abnormalities. The coronally T2-W sequences can be a guide. With this method when the lesion was detected on T2-W sequences the examination would be ended without administration of contrast material. By this method the time and the cost of the examination will be decreased, the cost effectiveness will be increased and the harmful effects of contrast material as NSF will be decreased.

In conclusion, by using the coronally T2-W sequences we will have faster scanning times and lesser usage of contrast medium. In this context, the coronally T2-W sequence is a valuable diagnostic sequence for the primary evaluation of the pituitary gland.


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