# Characterization of Adrenal Masses with Chemical Shift Imaging: FIESTA Sequence versus FSPGR T1WI Sequence

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## Introduction

In-phase and opposed-phase MR imaging has played an important role in characterization of adrenal masses, particularly for differentiating adrenal adenoma from other adrenal masses. In the majority of reports concerning chemical shift MR imaging of the adrenal gland, fast spoiled gradient-recalled echo (FSPGR) $T_1$-weighted imaging ($T_1$WI) sequences have been used [1-5]. However, to our knowledge, FIESTA (Fast Imaging Employing Steady State Acquisition) sequence has never been included in chemical shift MR imaging of the adrenal gland. In this study, we want to investigate the usefulness of chemical imaging with FIESTA sequence in characterization of adrenal masses in comparison with FSPGR sequence.

## Methods

The study population included 33 cases, and their diseases included Cushing adenoma in 4 cases, Conn adenoma in 3 cases, nonfunctional adenoma in 11 cases (12 lesions), adrenal pheochromocytoma in 4 cases, and adrenal metastases in 11 cases (16 lesions). All adrenal masses were proved by surgery (Fig A). Axial and coronal MR images were obtained with a Twinspeed (GE), and a phased array coils was used to receive MR signal. The pulse sequences included FSE T2WI, FSPGR T1WI (in-phase [TE=4.2 ms] and opposed-phase [TE=2.1ms]), and FIESTA sequence (in-phase [TR/TE=6.3ms/4.2 ms] and opposed-phase [TR/TE=3.8/1.9 ms]). The changes of signal intensity of the lesions in different sequence were analyzed.

## Results

***Adrenal adenoma:*** Compared with renal parenchyma, all 19 adenomas were isointense or mildly hyperintense on in-phase FSPGR $T_1$WI (Fig B). On in-phase FIESTA iamges, 11 adenomas were isointense, 6 were mildly or moderately hyperintense, and the other 2 were mildly hypointense. On opposed-phase FSPGR T1WI, 15 lesions became mildly or moderately hypointense (Fig C) and 4 were isointense. On opposed-phase FIESTA images, 16 lesions showed mildly or moderately hypointense (Fig D), and 3 were isointense.

***Adrenal pheochromocytoma and metastasis:*** On SPGR in-phase T1WI, 12 lesions showed isointense, and 8 were mildly hypointense. On in-phase FIESTA images, 16 lesions were mildly or moderately hyperintense, and 4 lesions were isointense. Compared with FSPGR in phase T1WI, no lesion showed obvious signal decrease on FSPGR opposed-phase T1WI. On opposed-phase FIESTA images, 15 lesions were mildly hyperintense, 4 were isointense, and 1 was mildly hypointense.

***Differentiation of adrenal adenoma from other masses:*** Criterion for differentiating adrenal adenoma from other masses was more than 15% decrease of "lesion to renal parenchyma signal intensity ratio" on opposed-phase FSPGR T1WI (comparison with in phase FSPGR T1WI) or opposed-phase FIESTA images (comparison with in-phase FIESTA images). The sensitivity and specificity of differentiation were 78.95% and 100% on FSPGR T1WI, while 84.21% and 95% on FIESTA images.

## Discussion and Conclusion

Most adrenal adenomas contain small amount of fat, while other common adrenal masses □including metastasis and pheochromocytoma□hardly contain fat [1-5]. So, it is very important to detect fat in adrenal lesions for differentiating adrenal adenomas from the other masses [1,3,4]. With a high sensitivity and specificity, chemical shift MR imaging using spoiled GRE $T_1$WI has been an indispensable tool for detecting small amount of fat within the adrenal lesions. Due to different precession phase between water and fat, the lesions containing fat show decreased signal intensity on opposed-phase $T_1$WI [1-5]. In this study, opposed-phase images were obtained with a FIESTA sequence in a reasonable short TE (1.9 ms). The lesions containing fat showed similar reduction of signal intensity on opposed-phase FIESTA images as on opposed-phase SPGR $T_1$WI. According to the results from surgery and histopathology, FSPGR T1WI chemical shift imaging sequence and FIESTA chemical shift imaging sequence got similar sensitivity and specificity for differentiating adrenal adenoma from other adrenal masses.

In Conclusion, our results indicate that compared with SPGR $T_1$WI chemical shift sequence, FIESTA chemical shift imaging sequence can provide similar sensitivity and specificity for characterization of adrenal masses, particularly for differentiating adrenal adenoma from other adrenal masses.

## References

1. Gabriel H, et al. J Magn Reson Imaging. 2004;19(3):308-16.
2. Slapa RZ, et al Eur Radiol. 2000;10(1):95-104.
3. Israel GM, et al . AJR Am J Roentgenol. 2004;183(1):215-9.
4. Haider MA, et al. Radiology. 2004;231(3):711-6.
5. Sohaib SA, et al. Radiology. 2000;214(2):527-31.

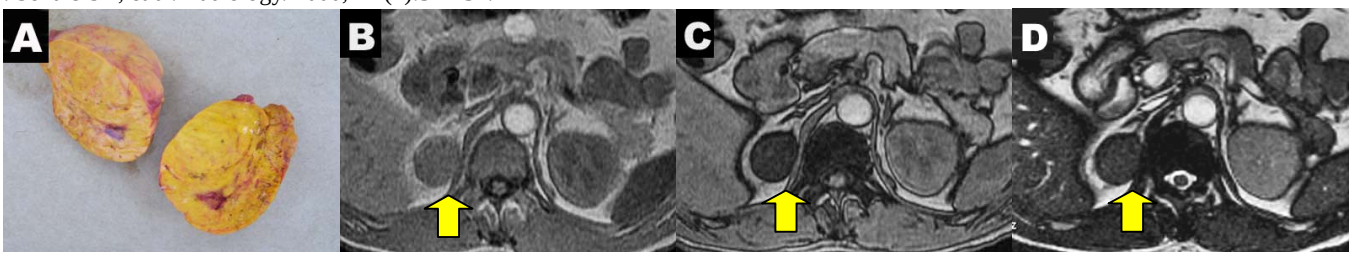


**Figure A-D.** A Cushing adenoma (yellow arrows) of the right adrenal gland in a 54 year-old man. A yellow adrenal adenoma specimen was showed in Fig A. On in-phase SPGR T1WI (Fig B), the lesion is isointense, compared with renal parenchyma. The lesion becomes dark on both opposed-phase SPGR T1WI (Fig C) and opposed FIESTA image (Fig D).