

# Dual Inversion Recovery MRI Helps Identifying Cortical Tubers in Tuberous Sclerosis

\*†‡Francois Cotton, §Loic Rambaud, and ¶Marc Hermier

\*Centre Hospitalier Lyon Sud, MRI Center, Pierre-Benite, 69495, France, †Laboratoire d'Anatomie, UFR Laennec, Lyon cedex 08, 69312, France, ‡CREATIS, INSA - 502, Villeurbanne, 69621, France, §Centre Hospitalier Lyon Sud, Neurology, Pierre-Benite, 69495, France, and ¶CREATIS, INSA - 502, Villeurbanne, 69621, France

**Summary:** *Purpose:* Dual inversion-recovery imaging (DIR) has been advocated for the diagnosis of cortical lesions in epileptic patients. The role of this sequence, however, is not established in tuberous sclerosis patients.

*Methods:* We studied prospectively the interest of DIR sequence in four well-documented consecutive tuberous sclerosis patients with focal epilepsy.

*Results:* In all patients, the cortical tubers appeared very bright on this sequence and were well outlined compared with high resolution T2 or FLAIR imaging. In two patients, one cortical

tuber was missed on T<sub>2</sub> weighted images due to signal intensity close to the CSF. These lesions were better depicted on DIR than on FLAIR. Three cortical lesions from two patients were visualized only on DIR.

*Conclusion:* DIR helped to depict cortical tubers and may have a complementary role in the MRI evaluation of tuberous sclerosis patients. There is a need to compare sensitivity of T<sub>2</sub>, FLAIR and DIR with a larger population of patients with focal epilepsies.

High resolution MRI plays a crucial role in the management of patients with focal epilepsy. However, some patients have no cortical or subcortical lesion at MRI (1). In patients suffering from tuberous sclerosis, the surgical prognosis depends on the concordance of MRI and EEG findings (2). Grey matter only imaging is a dual inversion-recovery sequence (DIR) using two slice selective 180° radiofrequency pulses with inversion times being set to cancel fat and white matter signals (3). Such studies have been advocated for the diagnosis of cortical lesions (4,5). The role of this sequence, however, is not established in tuberous sclerosis patients.

## MATERIALS AND METHODS

We studied prospectively the interest of DIR in four well documented consecutive tuberous sclerosis patients with focal epilepsy.

The number of cortical tubers was evaluated for each sequence by a consensual analysis of two neuroradiologist (MH, FC). Lesion visibility was classified as better,

similar, or lower between DIR versus T<sub>2</sub> and FLAIR sequences. A total of 17 cortical lesions was depicted.

## RESULTS

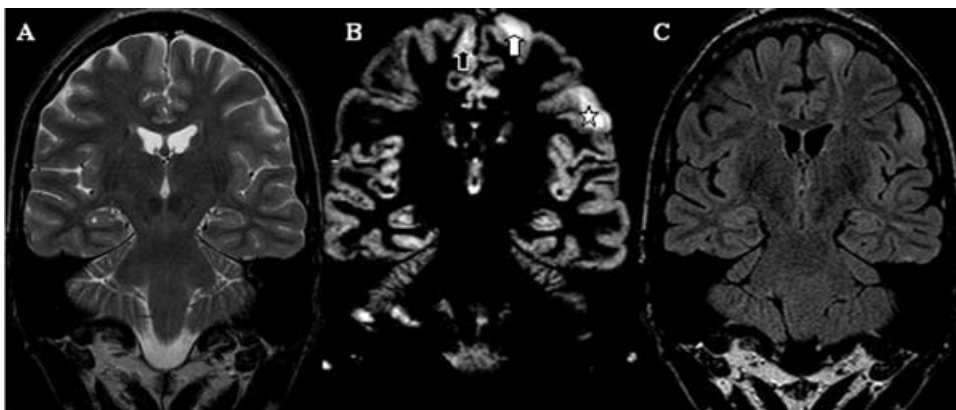
In all patients, the cortical tubers appeared very bright on this sequence and were well outlined compared with high resolution T<sub>2</sub> or FLAIR imaging. In two patients, one cortical tuber was missed on T<sub>2</sub> weighted images due to signal intensity close to the CSF. These lesions were better depicted on DIR than on FLAIR. Three cortical lesions from two patients were visualized only on DIR. However, in one patient, white matter lesions were better visualized on T<sub>2</sub> and FLAIR sequences rather than on DIR.

### Illustrative case

We report the case of a 35-year-old man, with a family history of tuberous sclerosis, a personal history of facial angiofibroma, and of partial epilepsy involving the right side of the body, beginning at the age of 8. He was admitted in our institution for the recrudescence of painful seizures despite therapy with Neurontin and Tegretol. Clinical examination revealed cold-induced dysesthesiae and protopathic reaction of the right upper limb. Interictal EEG and a previous MRI were considered normal. A second cerebral MRI was performed (Fig. 1) for the purpose of our study, including DIR. Cortical tubers appeared very bright

Accepted December 8, 2005.

Address correspondence and reprint requests to Dr. Francois Cotton, M.D, Ph.D., Department of Radiology, Centre Hospitalier Lyon Sud, F-69495 Pierre Bénite Cedex, France. E-mail: francois.cotton@chu-lyon.fr



**FIG. 1.** One well-outlined bright lesion, consistent with cortical tubers in the left post-central gyrus (star), was better demonstrated on coronal DIR “grey matter only” sequence (B) than on high resolution coronal T<sub>2</sub>-weighted image (A) and FLAIR sequence (C). The cortical tuber of the left paramedian superior frontal gyrus (white arrow) was missed on coronal T<sub>2</sub>-weighted image whereas the cortical tuber of the right paramedian superior frontal gyrus (black arrow) was missed on coronal FLAIR sequence.

on this sequence whereas some of them were almost impossible to identify with conventional MRI.

### DISCUSSION

DIR helped to depict cortical tubers and may have a complementary role in the MRI evaluation of tuberous sclerosis patients.

Using DIR, Rugg-Gunn and Symms (5) recently reported abnormal signal intensity in malformations of cortical development such as heterotopias and focal cortical dysplasia. These abnormalities involved the gray matter component of the lesion and the underlying white matter, probably reflecting heterotopic neurons, axonal demyelination gliosis. Abnormalities beyond the visually evident abnormalities were also reported voxel-based comparison with control subjects, implying additional sensitivity from DIR with respect to conventional imaging. There-

fore, there is a need to compare sensitivity of T<sub>2</sub>, FLAIR and DIR with a larger population of patients with focal epilepsies.

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