

# Differences in BOLD MRI signal intensity between hypertensive patients and healthy volunteers

M.C. Hendriks-Balk<sup>1</sup>, S. Da Costa<sup>3</sup>, E. Polychronopoulou<sup>1</sup>, A. Damianaki<sup>1</sup>, K. Theiler<sup>1</sup>, D. van de Ville<sup>3</sup>, P. Hagmann<sup>2</sup> and G. Wuerzner<sup>1</sup>

<sup>1</sup>Service of Nephrology and Hypertension and <sup>2</sup>Service of Radiology, Lausanne University Hospital and University of Lausanne, Switzerland, <sup>3</sup>Centre d'Imagerie BioMédicale (CIBM), Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

## BACKGROUND AND AIM

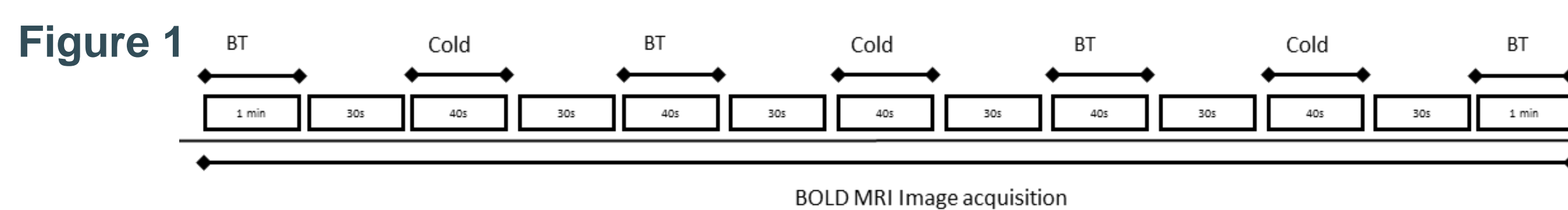
An increased sympathetic tone is associated with the initiation and maintenance of most forms of arterial hypertension. Background activity of a core network of neurons in the brain and brainstem is supposed to be important for long-term blood pressure control.

We have shown previously that blood oxygen level-dependent magnetic resonance imaging (BOLD MRI) detects changes in oxygenation within the brain and brainstem during a cold pressor test in health volunteers.

The objective was to compare the BOLD MRI signal intensity changes of a cold pressor test (CPT) in hypertensive (HT) patients and healthy normotensive (NT) participants

## METHODS

- Single center prospective case-control study in normotensive (NT) and hypertensive (HT) participants.
- A 7 tesla MRI scanner was used for MRI acquisition.
- BOLD MRI signal intensity changes during CPT (Fig 1) and during rest were analyzed using statistical parametric mapping (SPM) and custom scripts. The SUIT toolbox was used for brainstem-specific analysis during CPT and the CONN toolbox was used to analyze functional networks during rest



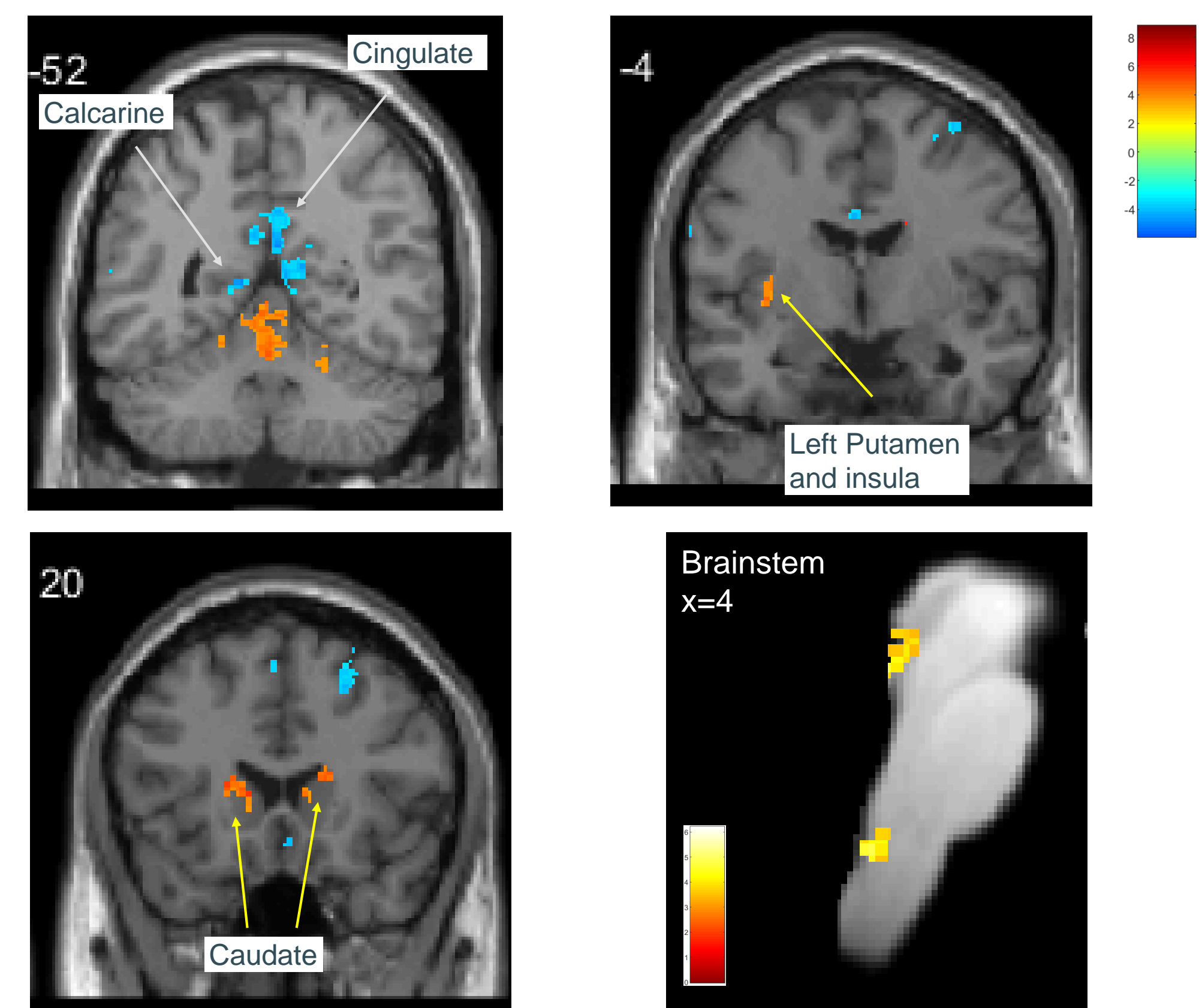
## RESULTS

- 31 NT and 20 HT were included
- Increases in BOLD fMRI signal intensities in response to CPT were seen in the caudate, left putamen, insula and the cerebellum in NT (Fig 2), but not in HT (Fig 3).
- Decreases in BOLD fMRI signal intensities upon CPT were seen in the calcarine and cingulate in NT, but not in HT.
- In NT an increase in BOLD fMRI signal intensity was seen in the dorsal medulla of the brainstem in response to CPT, but this change was absent in HT.
- Resting state analysis showed that HT (Fig 4B) have less functional connectivity between some of the resting state networks and less anti-correlation than NT (Fig 4A; red: positive correlation, blue: anti-correlation).

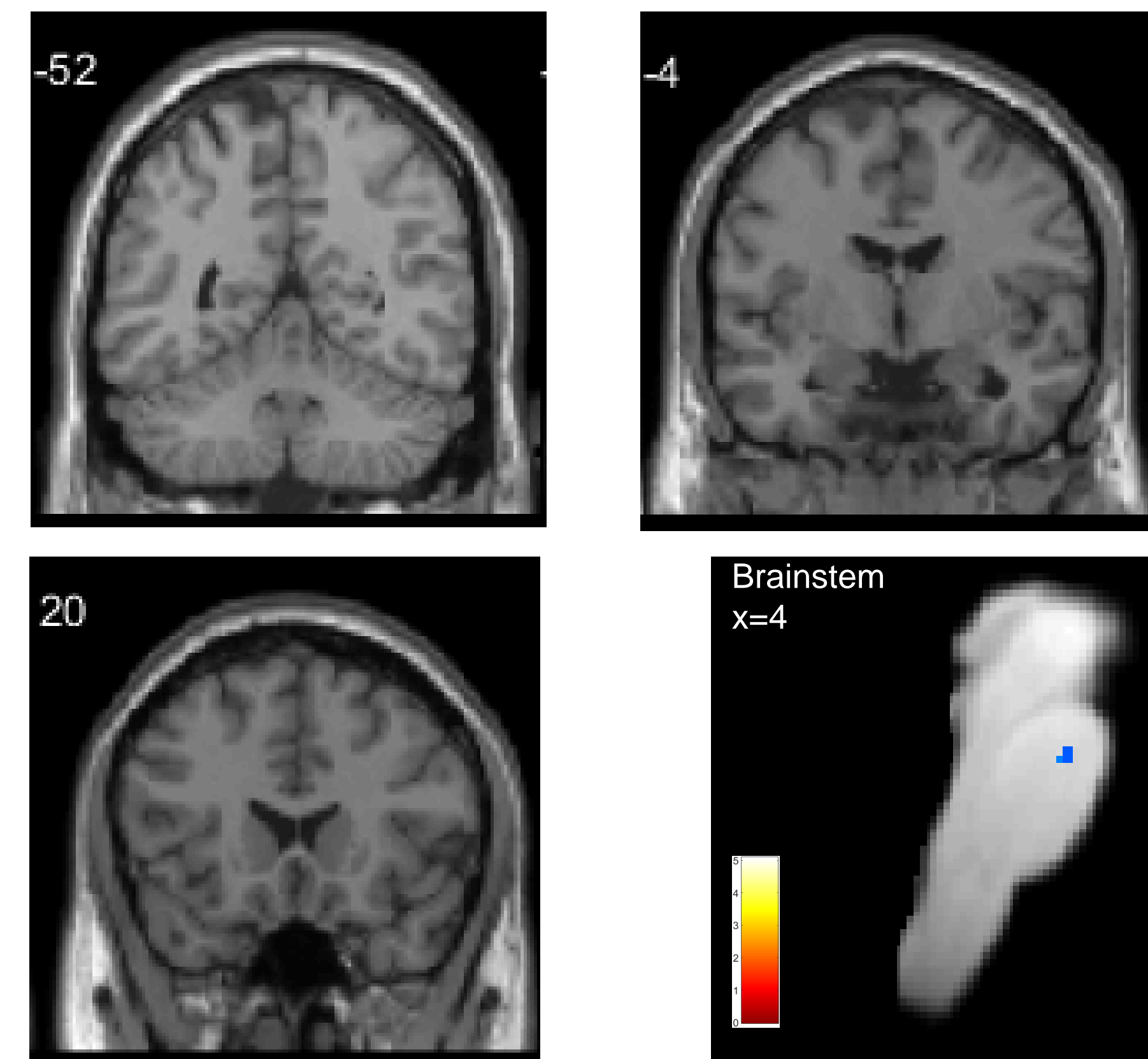
## CONCLUSION

HT patients display a blunted BOLD-FMRI response to CPT compared to NT. The functional connectome of the NT shows the prototypical segregation (by anti-correlated functional connectivity) between several networks. This segregation is clearly reduced (less negative) in HT, which indicates abnormality. This may explain the blunted BOLD-fMRI to CPT. Whether these changes are reversible need to be studied in the future.

**Figure 2**



**Figure 3**



**Figure 4**

