



Brain Activity Differences for Spontaneous Pain of Post Herpetic Neuropathy, Back Pain, and Acute Thermal Pain

P.Y.Geha¹, R.N. Harden², J. Paice³, M.N. Baliki¹, R.I. Jabakhanji¹, A.V. Apkarian¹
1. Department of Physiology, 2. Rehab Institute, 3. Department of Oncology and Hematology ;
Feinberg School of Medicine, Northwestern University, Chicago, IL 60611

SFN 2005
Washington DC
53.9

INTRODUCTION

Our recent fMRI studies indicate that spontaneous chronic back-pain (CBP) is associated with sustained activity in medial prefrontal cortex (mPFC), while thermal acute pain is associated with more parietal sensory and rostral cingulate activity. In this study, we examine brain activity related to spontaneous fluctuations of ongoing pain in post-herpetic neuropathy (PHN), using fMRI, and we contrast this activity pattern with that of spontaneous CBP, and acute thermal pain in normal subjects.

METHODS

11 PHN patients were studied with fMRI for spontaneous (stimulus independent) pain. All patients reported a history of PHN pain for at least 3 months after the resolution of the rash.

Patients were trained to use the finger-span device to rate magnitude of either their spontaneous pain, or that of a moving bar (motor-cognitive control) (panel 1).

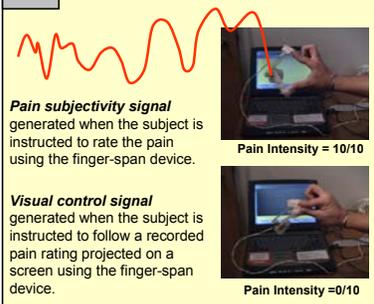
In the scanner the patients rated fluctuations of their spontaneous pain without any stimulation. Patients were scanned at multiple sessions.

The signals for pain and control scans are used to search for the BOLD signal and to control for various contaminants.

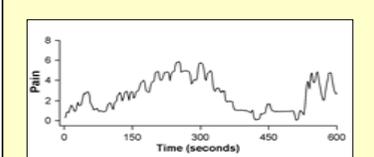
BOLD responses are determined using FSL software (fmrib, Smith et al. 2001).

The same method was used to collect data for the spontaneous fluctuations of CBP and for acute thermal painful stimulation of normal subjects (see Baliki et al., SFN 2002, 2003).

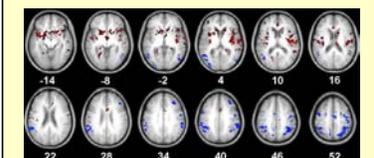
1 On-line signal for pain subjectivity



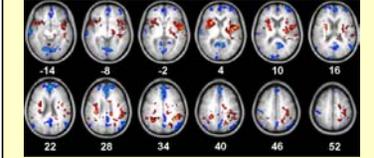
2 Brain activity for spontaneous PHN pain



Example of on-line PHN pain rating in one patient

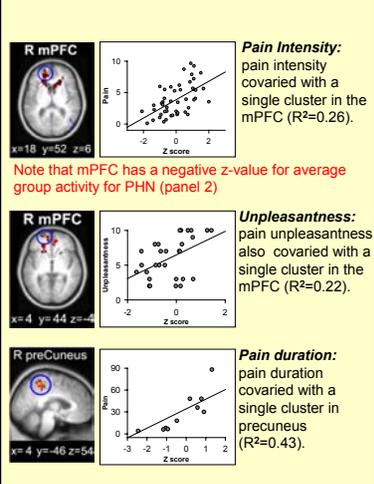


Random effect analysis average brain activity for PHN. Activity can be seen in bilateral insula, basal ganglia, and secondary somatosensory cortices.

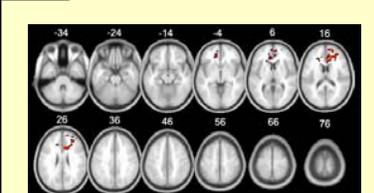


Fixed effect analysis average brain activity for PHN. Activity is similar to above, however more deactivations can be observed in frontal areas.

3 Covariate analysis between brain activity and PHN pain



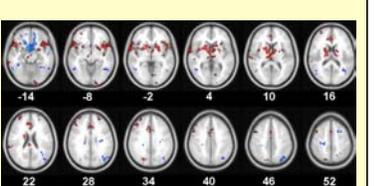
4 PHN pain v.s. CBP pain



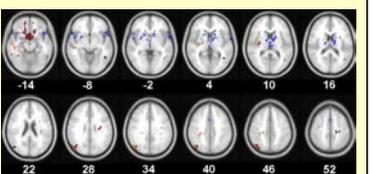
Average group brain activity for spontaneous CBP is 13 Chronic Back patients. Random effect analysis of (pain - visual control) shows that activity is limited to the medial prefrontal cortex and rostral anterior cingulate cortex.

Conjunction analysis between Brain activity for spontaneous back pain and that for PHN (panel 2) shows that there is no overlap between the 2 maps.

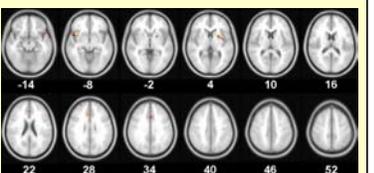
5 PHN pain v.s. Thermal pain in Healthy Controls



Average group brain activity for Thermal pain in 16 Healthy Controls. Random effect analysis of (pain - visual control) shows that activity is mainly bilateral and seen in insula, basal ganglia, thalamus, and anterior cingulate cortex.



Contrast analysis between PHN and thermal pain in Healthy Controls. Higher level contrast between the 2 groups reveals that the bilateral insular regions in addition to basal ganglia, thalamus and SMA are more active for thermal pain (blue). On the other hand, the frontal cortex and posterior parietal regions are more active in PHN (red).



Conjunction analysis between PHN and thermal pain in Healthy Controls. Higher level conjunction between the 2 groups reveals that the bilateral insular regions in addition to basal ganglia and anterior cingulate are commonly activated.

CONCLUSIONS

- Brain activity pattern for spontaneous fluctuations of PHN pain shows close similarity to activations seen in normal subjects due to thermal stimulation.
- This activity pattern shows no overlap with brain activity observed for spontaneous fluctuations of chronic back pain, regarding positive activity.
- However, the brain regions modulated with pain intensity and pain unpleasantness are the same areas as those activated in chronic back pain.
- It should be noted that the brain region that are less active in PHN vs. thermal pain in normal controls are areas not correlated with pain and unpleasantness fluctuations.
- Therefore, brain activity for PHN pain shares similarities with both acute thermal pain and with chronic back pain.

Funded by NIH NINDS 35115