Chronic post-herpetic neuropathy pain modulation by lidocaine patch: An fMRI-pharmacological study

P.Geha[1], O.Calvo[5], R.N. Harden[3], J. Paice[4], T. Parrish[2] D.R. Chialvo[1], A.V. Apkarian[1];

1.Department of Physiology, 2. Department of Radiology, 3. Rehab Institute, 4. Department of Oncology and Hematology;
Feinberg School of Medicine, Northwestern University, Chicago, IL 60611
5. Department of Physics, University of Islas Baleares, Palma de Mallorca, Spain

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INTRODUCTION

Chronic neuropathic pain conditions are usually resistant to pharmaco-therapy. LidoDerm patch is shown to be effective in reducing post herpetic neuropathy (PHN) pain. Here we present brain activity for PHN allodynia (painful touch), before and after LidoDerm therapy (acute and long-term); and compare it to brain activity for inflammatory pain and chronic back pain.

METHODS

• 11 PHN patients were studied with fMRI for tactile pain (allodynia). They refrained from analgesic medications for 24 hours prior to the study.

•We compare brain activity for arthritis pain (1 subject) and chronic back pain (average of 13 patients for spontaneous back pain).

•PHN patients were scanned prior, 6 hours, and 2 weeks post continuous use of LidoDerm patches.

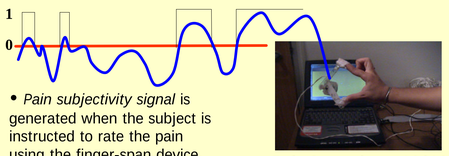
•Patients were trained to use the finger-span device to rate magnitudes (fig. 1).

•In the scanner the patients rated fluctuations of their pain to mechanical stimuli applied either to the body area having PHN or to a control area (fig.2).

• The signals for pain and various control scans are used to calculate vectors 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).

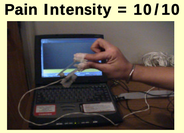
1 On-line signal for pain subjectivity



• *Pain subjectivity signal* is generated when the subject is instructed to rate the pain using the finger-span device.

•*Visual control signal* is generated when the subject is instructed to follow a recorded pain rating projected on a screen using the finger-span device.

Pain Intensity = 10/10



Pain Intensity =0/10

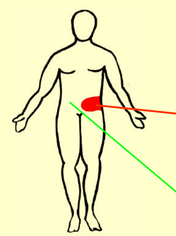
• *A binary vector (P_s)* for high - low ongoing pain upon external stimulation to the affected area is generated.The mean value of stimulus pain rating signal is calculated. Pain ratings having a value larger and smaller than the mean are designated by 1 and 0, respectively.

•*A binary vector (P_b)* for high - low ongoing spontaneous fluctuations of PHN pain.The mean value of the pain rating signal is calculated. The peak ratings are averaged across all patients in figure 4, for each condition.

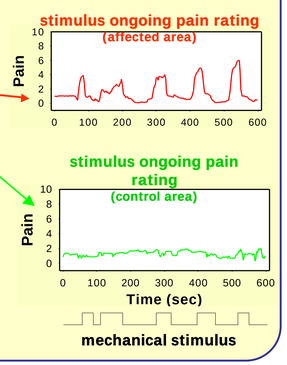
•*A binary vector (P_c)* for tactile stimulus timing upon stimulation to the control area is generated.

•*A binary vector (**V**)* for visual control is generated from the visual control signal in a similar fashion to P_s.
BOLD responses to ***V*** control for motor component.

2 Tactile stimulus evoked pain ratings

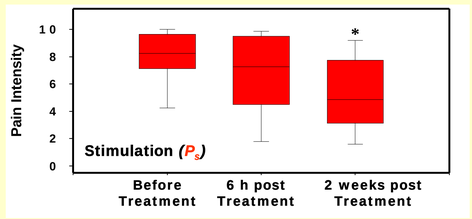


Mechanical stimuli are applied using a brush to the affected (red) and control (green) areas during different scans within a given session.



RESULTS

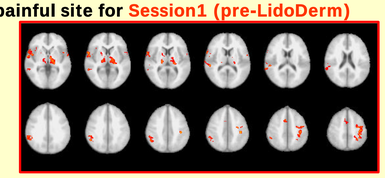
3 Pain ratings are reduced with LidoDerm use



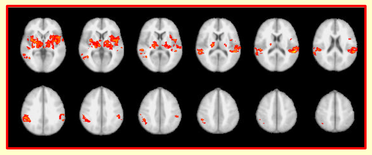
Median and range are shown for allodynia pain. Verbal reports. * Significantly reduced, p <0.05.

4 Stimulus-evoked brain activity increases after LidoDerm use

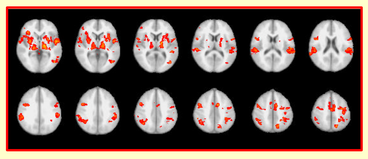
Activity map for the group average, 11 subjects, for mechanical stimulation of painful site for Session1 (pre-LidoDerm)



for Session2 (6-hours post-LidoDerm)

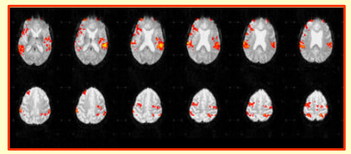


for Session3 (2 weeks post-LidoDerm)



Tactile and pain representation areas as well as areas involved in performing the task (motor & attentional) are activated. Note that as the stimulus pain (Ps) intensity is decreasing as shown in Fig. 4 , brain activity is increasing.

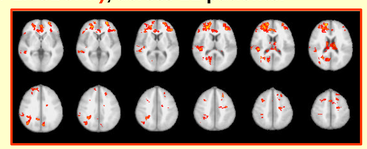
5 A single PHN subject brain activity for tactile stimulation in the control area



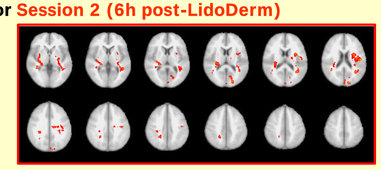
A large portion of this activity is common to the areas seen for mechanical stimulation of painful site. This implies that the increased activity is mainly due to increased tactile sensitivity for pain relief.

6 Brain activity co- varying with allodynia pain decreases after LidoDerm use (*Ps*)

When mechanical stimulation results are covaried with pain rating, a very different pattern of activity is observed, for Session1 (pre-LidoDerm), across 11 patients.



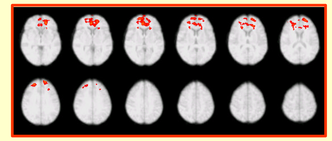
for Session 2 (6h post-LidoDerm)



for Session 3 (2 weeks post-LidoDerm)

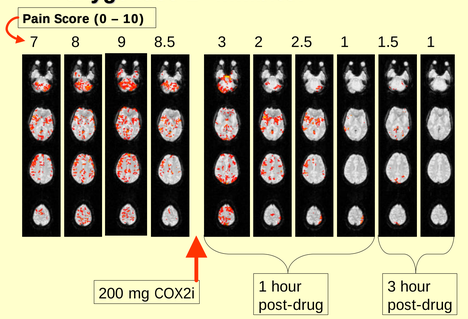
Brain regions activated specifically in relation to pain decrease as pain intensity is decreased with therapy.

7 Brain activity in chronic back pain, average 13 patients, for spontaneous fluctuations of pain



Activity pattern is limited to medial prefrontal cortex. The pattern is similar to that seen for PHN pain, prior to therapy

8 Activity map for joint stimulation pain in a single arthritis patient, before & after a dose of cyclo-oxygenase 2- inhibitor



Stimulus pain is given for each scan on a 0-10 scale. Administration of the analgesic reduces joint pain and also reduces stimulus induced brain activity, over 5 hours & 10 scans.

CONCLUSIONS

• Initial analyses indicate that PHN allodynia pain involves similar brain regions as in back pain, and different from arthritis pain.

• LidoDerm treatment seems to decrease brain activity for allodynia pain and increases activity for touch.

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