Emotional Response of Cold-Pressor: an Autonomic Outlook

Srini Nageshwar, Pranesh Jayabalalan, Melvyn J. Lafitte
DyAnsys, Inc.

Background: Many psychological variables bear upon pain, in particular emotional aspects which play a major role. The cold pressor test (CPT) constitutes an empirically validated pain-induction technique. Better emotional repair purportedly allows less sensory pain while undergoing CPT (in women according to [1]). The autonomic nervous system (ANS) activity is modernly considered as a major component of the emotional response.

Objective: We propose to explore the various emotional facets of acute pain from a cardiac autonomic standpoint. The variability in experiencing CPT across a mixed-gender population is regarded according to ANS changes.

Methods: 13 healthy volunteers (5 women, 8 men), age ranging from 18 to 36 years, underwent a 5 minutes CPT with hand immersion in ice-cold water. Electrocardiographic (EKG) signal was recorded throughout the experiment, both during, ante- and post-CPT. Subjects were supine tested for normal autonomic function during 7 minutes; autonomic dysfunction (using ANSiscope of Dyansys, Inc.) varied from 12 to 26%, much below the 41% abnormality threshold. During the CPT, participants rated their perception of the sensory and affective pain, every 15 seconds, using a numerical rating scale, ranging from 0 to 10. Emotional variations were evaluated by the investigator using Positive and Negative Affect Schedule (PANAS) before and in the 2 minutes post-CPT. The subjects were then asked to stand, in order to measure their cardiac response to orthostatic stress. The ANSiscope was used to monitor beat-to-beat ANS changes extracted from the EKG recordings.

Results: 12 out of 13 cases showed a systemic sympathetic local activation associated with the highest level of perceived pain. However, both the timings of acute pain and of numbness varied considerably across subjects. Of 9(1) cases which presented vagal co-activation during the CPT, at least two women and four men combined a strong parasympathetic activation with the sympathetic drive during the final orthostatic test. These 6(2) cases were found to have the best emotional repair according to their PANAS scores before and after the CPT.

Conclusions: Though we found no universal autonomic response to CPT, we cautiously (population size should be increased to allow proper statistical testing) observed a vagal origin to the equivalence between good emotional regulation and good coping with pain, regardless of gender.


12 cases chart with indications for gender, age, PANAS post- and pre-CPT difference score, autonomic dysfunction (orange %), sympathetic and parasympathetic descriptors (respectively, blue and green dots), pain scale (shades of orange). The N marker indicates numbness while HUT refers to the final standing test.