Emotional modulation of pain and the nociceptive flexion reflex across the menstrual cycle in women with and without premenstrual dysphoric disorder

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Introduction

Premenstrual dysphoric disorder (PMDD) is associated with a disruption of mood and pain processing; specifically, women with PMDD appear to be hyperalgesic. At this time, it is unclear whether this hyperalgesia is due to abnormalities in emotional modulation of pain. This laboratory has demonstrated that the Emotional Controls of Nociception (ECON) paradigm is a valid tool for studying supraspinal modulation of pain and centriopontine modulation of spinal nociception (assessed by the nociceptive flexion reflex, NFR). In this paradigm, a series of emotionally-charged pictures are presented, during which PMDD, electrodermal stimuli are delivered to the sural nerves of the ankle. Prior research has shown that emotional pictures elicit pain and NFR, whereas modulation pictures elicit pain and NFR. This study used ECON to examine emotional modulation of pain in PMDD.

Objective

To determine whether emotional modulation of pain and spinal nociception (as measured by NFR) is disrupted in women with PMDD.

Experimental Procedures

Pain tested during mid-follicular, ovulatory, and late-luteal phases. Order of testing counterbalanced across participants. NFR and pain thresholds were verified using spinal opponents. NFR thresholds and pain thresholds were determined prior to picture viewing. Participants viewed mutilation, neutral, and erotic pictures in pseudorandom order. During 50% of pictures, suprathreshold electric stimulations were delivered to sural nerve with an intensity that was 120% of pain threshold and 120% of NFR threshold (whichever was higher). Pain ratings and NFR magnitudes were recorded in response to each stimulus.

Nociceptive Flexion Reflex (NFR)

NFR is a spinally-mediated protective withdrawal reflex elicited by a low frequency, and NFR magnitude correlates with pain. NFR magnitude was indexed as the area under the curve (AUC) of the NFR window. NFR was measured in baseline trials and during pictures (a 60 ms pre-stimulus baseline was included into each 50 ms NFR window).

Participants

Healthy Controls (n = 20) and PMDD (n = 20)

No significant differences between groups on relevant demographic variables (i.e., age, race, sexual orientation, years of education, employment, or marital status)

Diagnosis for PMDD was determined prospectively through completion of daily diaries, luteinizing hormone (LH) and follicle stimulating hormone (FSH).

Exclusion Criteria:

Menstrual or postmenopausal
Use of hormone preparations within past 6 months
Failure to regularly cycle within 2 months of study inclusion
Diagnosis for PMDD was determined prospectively through completion of daily diaries, luteinizing hormone and follicle stimulating hormone.

Results: Emotional Modulation of Pain

Pain outcomes were analyzed by diagnosis (PMDD vs. HC), menstrual phase (mid-follicular, ovulatory, late-luteal), and Picture Content (neutral, mutilation, erotic) with a 2 (Diagnosis) x 3 (Menstrual Phase) x 3 (Picture Content) mixed factorial ANOVA.

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Conclusions

Emotional reactions to pictures were more intense in women with PMDD experienced greater displacements in response to erotic and neutral pictures, but greater arousal in response to mutilation pictures. Pain ratings for women with PMDD were generally lower during ovulation for women with PMDD, whereas pain was lower during late-luteal and early follicular phases for controls.

By contrast, there were group differences in emotional modulation of NFR, an effect that was influenced by factors such as menstrual phase. Emotional modulation of NFR was present only during the late-luteal phase. Women with PMDD women emotionally modulated NFR during the mid-follicular and ovulatory phases, but absent during the late-luteal phase.

These findings suggest there are differences in emotional processing, pain modulation, and modulation of spinal nociception in women with PMDD. These differences could contribute to PMDD-related symptomatology.

Results with pictures of women with PMDD were obtained from the Virginia Center for the Assessment of Behavior and Technology (VCABT).