Major depressive disorder is associated with a disruption of supraspinal modulation pain, but intact corticospinal modulation of spinal nociception

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Introduction

Previous research has noted a bidirectional relationship between major depressive disorder (MDD) and chronic pain. Specifically, MDD is associated with increased pain and pain-related symptoms, and chronic pain is associated with increased rates of MDD. While the mechanisms contributing to this bidirectional relationship are likely to be multifactorial, one contributing factor could be a disruption of endogenous processes related to emotional modulation of pain and nociception. The present study used a well-validated method to engage emotional modulation, a paradigm referred to as Emotional Controls of Nociception (ECON). ECON involves delivering suprathreshold electrocutaneous stimuli to the sural nerve during a series of pictures varying in emotional content (e.g., erotic, neutral, mutilation). Prior research has shown that erotic pictures inhibit pain and the electrocutaneous stimuli to the sural nerve during a series of pictures varying in emotional content (e.g., erotic, neutral, mutilation). Pain ratings made following each stimulation using a computer.

Objective

The present study examined whether MDD is associated with a disruption in supraspinal and/or corticospinal processes.

Participants

25 Pain-Free Participants with and without MDD (11 MDD, 14 Controls)
- MDD Demographics: 7 Males, 4 Females; White non-Hispanic (82%), married (51%), employed full-time (18%), average age = 34 yrs (SD=12.12)
- Healthy Control Demographics: 4 Males, 10 Females; White non-Hispanic (88%), married (51%), employed full-time (36%), average age = 48 yrs (SD=11.93)
- Exclusion Criteria:
  - <18 yrs of age
  - Cardiovascular, neurological, circulatory problems
  - Chronic pain condition (e.g., back pain)
  - Recent use of analgesic medication
  - Current use of amphetamine, antidepressant, and/or anxiolytic medication

Procedure

- 60 min: Overview, Informed Consent, & Eligibility Determination
- 5 min: Apply Sensors
- 30 min: Questionnaires
- 5 min: Record Resting Physiology
- 15 min: Picture Viewing Block 1 - noses presented randomly
- 15 min: Leg Reflex Testing - using electric stimulations
- 5 min: Record Resting Physiology
- 15 min: Picture Viewing Block 2 - electric stimulations presented randomly
- 5 min: Record Resting Physiology
- 15 min: Picture Viewing Block 3 - pictures presented randomly
- 5 min: Final Questionnaires

Data Analysis

Mixed models in SPSS were used, followed by mean comparisons to significant F-tests were conducted with Fisher’s LSD tests. Pain and NFR were converted to within-subject z-scores.

Results: NFR

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<tr>
<th>MDD (n=11)</th>
<th>Controls (n=14)</th>
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<td>NFR magnitude was greater during mutilation (MUT) pictures and lower during erotic (ERO) pictures.</td>
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Results: Pain Ratings

- Emotional modulation of pain ratings was found in Controls (p<.001), but not MDD (p=.524).
- Pain ratings were greater during mutilation (MUT) pictures and lower during erotic (ERO) pictures.
- Emotional modulation of pain ratings did not occur in MDD.

Conclusions

- Results indicated that ECON modulation of NFR present in both MDD and Controls.
- By contrast, ECON modulation of pain ratings was found in Controls, but not MDD.
- Together, these results suggest that corticospinal processes that modulate spinal nociception are intact in MDD, but supraspinal processes that modulate pain report are disrupted.
- MDD patients fail to modulate pain perception during emotional pictures, but do engage cerebrospinal mechanisms to emotionally modulate the nociceptive flexion reflex (NFR, a physiologic measure of spinal nociception) could represent a predisposition for the future development of chronic pain in persons with MDD.