

Trauma and Pain Sensitization in Youth with Chronic Pain

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Background

- Pediatric chronic pain (pain lasting ≥ 3 months) is highly comorbid with internalizing mental health conditions, including posttraumatic stress symptoms (PTSS), anxiety, and depression [1-4].
- PTSS, including re-experiencing intrusive memories, alterations in cognition and mood, hyperarousal, and avoidance, could lead to altered neuronal processing, pain sensitization, and greater reports of pain [5].
- Additionally, trauma-induced alterations to corticolimbic circuitry may result in altered cognitive-emotional processing, thereby influencing pain sensitivity.
- Pain catastrophizing (i.e., the tendency to magnify, ruminate and feel helpless regarding the threat of pain [6]), may lead to increased bodily sensations, which could potentially lead to higher pain intensity and pain sensitivity following exposure to a painful stimulus [7].
- The relationship between PTSS and pain sensitization in youth with chronic pain are not known.
- We hypothesized that youth with greater PTSS would demonstrate higher state pain catastrophizing, greater expected and experienced pain, and lower pain thresholds as compared to youth with lower PTSS and chronic pain.

Objectives

- In the present study, we examined the relationships between PTSS, state pain catastrophizing, pain intensity, and pain thresholds in youth with chronic pain.

Methods

- Youth (n=190) aged 10-18 years were recruited from outpatient multidisciplinary chronic pain programs. Youth were eligible if they identified as having chronic pain, without underlying disease.
- PTSS, anxiety and depressive symptoms, state pain catastrophizing, and pain intensity were assessed using psychometrically-sound questionnaires: Child PTSD Symptom Scale (CPSS-V), Revised Child Anxiety and Depression Scale (RCADS), Pain Catastrophizing Scale (PCS), and Numerical Rating Scale (NRS).
- Youth also underwent a cold-pressor task (CPT). Prior to the task, they reported on their expected pain intensity and state pain catastrophizing. During the task, their pain threshold (length of time in the water) was recorded. After the task, their pain intensity score and state pain catastrophizing score were again recorded.
- Hierarchical linear regression analyses were performed to examine whether:
 - PTSS were associated with pain intensity before and after the cold pressor task;
 - PTSS were associated with pain tolerance; and 3) PTSS were associated with state pain catastrophizing before and after the cold pressor task.
 - Analyses were controlled for age, gender, ethnicity, anxiety, and depressive symptoms.

Results

Table 1: Cohort Characteristics

Characteristics	Total n = 190	*Lower PTSS (0-11) n = 88	*Higher PTSS (0-11) n = 87	P
Age, M (SD)	14.3 (2.3)	13.9 (2.4)	14.56 (2.1)	0.05
Gender (female), N (%)	131.0 (68.9)	62.0 (70.5)	63.0 (72.4)	0.87
Ethnicity (white), N (%)	145.0 (76.3)	73.0 (83.0)	66.0 (75.9)	0.22
Income (>\$90,000), N (%)	105 (55.3)	49 (55.7)	52 (59.8)	0.57
Self-Reported Symptoms, M (SD)				
Anxiety Symptoms	31.0 (20.9)	19.7 (15.3)	42.3 (20.3)	<0.001
Depressive Symptoms	9.7 (6.4)	6.4 (5.0)	12.9 (6.0)	<0.001
PTSS	16.8 (16.9)	4.3 (3.8)	29.5 (15.5)	<0.001
Cold-Pressor Task, M (SD)				
Pain Expectation	3.7 (1.2)	3.1 (2.0)	4.4 (2.1)	<0.001
State Catastrophizing (Before)	4.6 (5.1)	2.8 (3.6)	6.7 (5.7)	<0.001
Pain Threshold (minutes)	2.7 (1.6)	2.3 (1.6)	3.0 (1.4)	0.001
Pain Intensity	4.1 (2.3)	4.3 (2.4)	4.1 (2.2)	0.72
State Catastrophizing (After)	4.9 (5.6)	3.9 (4.6)	6.1 (6.4)	0.01

- Higher PTSS ($\beta = 0.35$, $t(157) = 3.31$, $p = 0.001$) were associated with greater state pain catastrophizing prior to the CPT. PTSS explained 20% of the variance in pain catastrophizing about the CPT-related pain.
- Older youth ($\beta = 0.31$, $t(159) = 3.88$, $p < 0.001$, $R^2 = 0.11$) with higher PTSS ($\beta = 0.24$, $t(159) = 2.19$, $p = 0.03$, $R^2 = 0.04$) had higher pain thresholds; thereby, they were able to submerge their hand for a longer period during the CPT.
- Higher PTSS ($\beta = 0.24$, $t(159) = 2.10$, $p = 0.04$) were associated with higher state pain catastrophizing after the CPT. PTSS explained 8% of the variance in pain catastrophizing about the CPT-related pain.
- None of the variables were associated with pain intensity ratings following the CPT ($F(6,157) = 0.86$, $p = 0.53$).



Conclusions

- Higher PTSS were associated with greater state catastrophizing and greater pain thresholds, as compared to individuals with lower PTSS, after accounting for age, gender, ethnicity, anxiety and depressive symptoms.
- A recent meta-analysis of pain processing and perception revealed that individuals with combat-related trauma showed significant increases in thresholds for pain [8], resembling youth with higher PTSS.
- Re-experiencing pain in youth with chronic pain and higher PTSS may be associated with increased symptoms of hyperarousal and magnification. Moreover, their heightened pain-related anxiety may be associated with greater dissociation and pain avoidance, resulting in higher pain thresholds.
- Stress-induced analgesia may also underlie the increased pain threshold observed in youth with higher PTSS. Stress-induced analgesia can trigger a network of brain responses, resulting in the activation of hyperarousal [9-10], thereby perpetuating chronic pain conditions in youth.
- Mutually maintaining feelings of hyperarousal and dissociation correspond to alterations in corticolimbic activity. Continuous activation and de-activation of corticolimbic networks may lead to structural changes within these brain regions that are associated with the chronification of pain [11-15].
- Managing PTSS in youth clinically may prevent corticolimbic changes, which may in turn interrupt the persistence of chronic pain.

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