



ORIGINAL ARTICLE

Peritraumatic tonic immobility is associated with posttraumatic stress symptoms in undergraduate Brazilian students

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Abstract

Objective: Tonic immobility is a defensive reaction occurring under extreme life threats. Patients with posttraumatic stress disorder (PTSD) reporting peritraumatic tonic immobility show the most severe symptoms and a poorer response to treatment. This study investigated the predictive value of tonic immobility for posttraumatic stress symptoms in a non-clinical sample. **Methods:** One hundred and ninety-eight college students exposed to various life threatening events were selected to participate. The Posttraumatic Stress Disorder Checklist - Civilian Version (PCL-C) and tonic immobility questions were used. Linear regression models were fitted to investigate the association between peritraumatic tonic immobility and PCL-C scores. Peritraumatic dissociation, peritraumatic panic reactions, negative affect, gender, type of trauma, and time since trauma were considered as confounding variables. **Results:** We found significant association between peritraumatic tonic immobility and PTSD symptoms in a non-clinical sample exposed to various traumas, even after regression controlled for confounding variables ($\beta = 1.99$, $p = 0.017$). **Conclusions:** This automatic reaction under extreme life threatening stress, although adaptive for defense, may have pathological consequences as implied by its association with PTSD symptoms.

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DESCRITORES:

Transtorno de estresse pós-traumático;
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 Outras áreas de pesquisa (Imobilidade tônica);
 Outros grupos de pacientes/questões (Amostra não clínica).

A imobilidade tônica peritraumática está associada aos sintomas do transtorno de estresse pós-traumático em estudantes brasileiros de graduação

RESUMO

Objetivo: A imobilidade tônica é uma resposta defensiva que ocorre sob ameaça extrema à vida. Pacientes com transtorno de estresse pós-traumático (TEPT) que relatam imobilidade tônica peritraumática são os que apresentam os sintomas mais graves e a pior resposta ao tratamento. Este estudo investigou o valor preditivo da imobilidade tônica para os sintomas de TEPT em uma amostra não clínica. **Métodos:** Os participantes da pesquisa foram 198 estudantes universitários expostos a traumas diversos. A versão brasileira do *Post-Traumatic Stress Disorder Checklist - Civilian Version* (PCL-C) e questões referentes à imobilidade tônica foram empregadas. Modelos de regressão linear foram utilizados para investigar a associação dos sintomas de estresse pós-traumático com a imobilidade tônica peritraumática. Foram consideradas como variáveis de confusão a dissociação peritraumática, as reações físicas de pânico peritraumática, o traço de afeto negativo, o gênero, o tipo de trauma e o tempo de trauma. **Resultados:** Encontrou-se uma associação significativa entre a imobilidade tônica peritraumática e os sintomas de TEPT em uma amostra não clínica exposta a traumas diversos mesmo quando controlada por variáveis de confusão ($B = 1,99$; $p = 0,017$). **Conclusões:** Esta reação defensiva que ocorre sob intensa ameaça, apesar de adaptativa para a defesa, pode ter consequências patológicas como sugere sua associação aos sintomas de TEPT.

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Introduction

A considerable number of research studies have attempted to identify factors associated with the development of posttraumatic stress symptoms and posttraumatic stress disorder (PTSD) after exposure to traumatic events,¹ as it may give clues to new targets for prevention and treatment of trauma-related disorders. Reactions occurring at the time of a traumatic event and shortly thereafter (e.g., peritraumatic responses) are well established risk factors for psychopathological outcomes. Peritraumatic dissociation, in particular, has been associated with the development of posttraumatic stress symptoms in survivors of natural disaster, combat veterans, victims of motor vehicle accidents, and physical trauma survivors.²⁻⁵ In fact, an influent meta-analysis by Ozer et al.⁶ found peritraumatic dissociation to be the strongest predictor of PTSD or of its symptoms among several variables, such as trauma characteristics prior exposure and adjustment, or concurrent psychopathology. Some studies have also highlighted the importance of peritraumatic panic reactions in explaining PTSD development.^{7,8}

Tonic immobility, a far less investigated peritraumatic reaction in humans, has been studied in animals for over three centuries.⁹⁻¹¹ Tonic immobility is characterized by reversible immobility, analgesia, and relative unresponsiveness to external stimulation elicited in a context of inescapable threat.¹²⁻¹⁴ Its adaptive value is supported by the fact that the absence of movement increases the odds that a captured animal will escape, as the predator may loosen its grip if it assumes that the prey is indeed dead.^{15,16} This response is considered the last-ditch defense against entrapment by a predator within a sequence of defensive responses, namely

freeze, flight, fight, and tonic immobility.¹⁷ Tonic immobility is different from freezing behavior, which occurs early in the encounter stage of the defensive reflex. Freezing is an initial response during which the animal stops moving to avoid detection and shifts resources to locate the predator and is associated with increased responsivity to stimuli and alert posture.¹⁸⁻²¹ Freezing was shown to occur in humans when confronted with a potential threat (pictures of injured people) through objectively measuring the body sway, and it is accompanied by bradichardia.^{22,23} Tonic immobility, on the other hand, was shown to involve motionless posture along with accelerated heart rate under very high threat (Volchan et al., submitted).

Early studies of tonic immobility in humans have focused on female victims of sexual assault.²⁴ Further studies found that tonic immobility predicts posttraumatic stress symptoms in non-clinical and clinical female victims of sexual assault.²⁴⁻²⁶ Our group recently investigated mixed-gender samples exposed to urban violence and found that peritraumatic tonic immobility predicted both the severity of posttraumatic stress symptoms and a poor response to pharmacological treatment in PTSD patients.²⁷⁻²⁹

The aim of the present study was to investigate the association between peritraumatic tonic immobility and posttraumatic stress symptoms in a non-clinical sample exposed to a broad variety of traumatic events. Studies carried out with non-clinical samples present many advantages given that they reduce the biases of more severe cases, higher prevalence of comorbidities, medication and higher levels of functional impairment, which are seen in clinical samples. We hypothesized that, even in a relatively healthy group exposed to life threatening events, peritraumatic tonic

immobility would predict the severity of symptoms after controlling for confounders, particularly peritraumatic dissociation, peritraumatic panic reaction, negative affect, type of trauma, gender, and time since trauma. By controlling for these variables we aimed to seek a unique relationship between tonic immobility and posttraumatic stress symptoms.

Methods

Participants

All participants ($n = 338$) were undergraduate students from Universidade Federal Fluminense. Participants who failed to fully complete the questionnaire battery and who did not meet the Criterion A1 of the DSM-IV for PTSD were excluded. The final sample was composed of 198 young adults, predominantly women (80%), aged 18-52 years ($M = 20.3$; $SD = 2.93$).

Measures

Questionnaires were distributed in classrooms, and volunteers had one hour to complete them. Posttraumatic stress symptoms were assessed using the Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C; translated and adapted to Portuguese by Berger and collaborators).^{30,31} PCL-C is a 17-item self-report measure of the severity of intrusive, avoidance, and hyperarousal symptoms experienced in response to a stressful life event. Using a 5-point Likert scale (1 = not at all, 5 = extremely), participants rated the extent to which each symptom has bothered them in the past month. At the beginning of the PCL-C, the volunteers had to describe the index trauma to which the symptoms were rated. The question was: What was the most severe traumatic event in your life?

Our evaluation of peritraumatic tonic immobility was based on the Tonic Immobility Scale Child Abuse Form (TIS-C).³² To avoid item overlap with other peritraumatic reactions, a four-item measure of motor aspects of tonic immobility was used: (i) rate the degree to which you were frozen or paralyzed during the event (from 0 = not at all frozen or paralyzed; to 6 = completely frozen or paralyzed); (ii) rate the degree to which you were unable to move even though not restrained during the event (from 0 = could move freely; to 6 = could not move at all); (iii) rate the degree to which you were unable to call out or scream during the event (from 0 = could scream freely; to 6 = could not scream at all); (iv) rate the extent to which you felt unable to escape during the event (from 0 = could escape easily; to 6 = could not escape at all but remain "fixed"). Peritraumatic dissociation was assessed using the Peritraumatic Dissociative Experiences Questionnaire (PDEQ; translated and adapted to Portuguese by Fiszman and collaborators).^{33,34} For each of the 10 items of the PDEQ, the subject was asked to rate in a 5-point Likert scale the extent to which he/she had experienced each dissociative phenomenon during or immediately after trauma exposure. The Physical Reactions Subscale (PRS)³⁵ was used to measure peritraumatic panic reactions. Ten items measured on a four-point Likert-type scale assess the intensity of physical symptoms experienced during the

traumatic event. The negative affect trait was measured by the Positive and Negative Affect Schedule - Trait Version (PANAS-T).³⁶ The PANAS is a 20-item scale consisting of 10 adjectives that describe negative and positive mood traits. In order to evaluate the number of types of life-threatening trauma exposure, the Trauma History Questionnaire (THQ; translated and adapted to Portuguese by Fiszman and collaborators)^{37,38} was used. The THQ is a list of 23 potentially traumatic events, including crime, disaster, and physical and sexual assaults. It also contains an open-ended question for specifying other extraordinarily stressful situations or events.

Statistical Analysis

Means and standard deviation were calculated for psychometric scales. Linear regression models were fitted to investigate the association between peritraumatic tonic immobility (independent variable) and PCL-C scores (dependent variable). Potential confounders were sequentially included in the model according to their impact on the magnitude of the linear coefficient, and p -values equal or less than 0.05 were regarded as statistically significant.

Ethical Issues

This study was approved by the Internal Review Board of the Federal Fluminense University (Niteroi, Brazil) and the process number of the Research Committee approval is 203/09. The 338 undergraduate students provided written informed consent before assessment.

Results

The most traumatic life events reported for completing the PCL-C included death/loss of someone close to you ($n = 64$), violent crime ($n = 50$), medical causes ($n = 45$), vehicle accident ($n = 17$), child abuse ($n = 5$), domestic violence ($n = 5$), injury ($n = 5$), natural disaster ($n = 2$), and others ($n = 5$). The mean scores of our sample were 29.7 ($SD = 10.9$, $min = 17$, $max = 70$) for posttraumatic stress symptoms; 8.9 ($SD = 6.9$, $min = 0$, $max = 24$) for tonic immobility questions; 18.7 ($SD = 20.7$) for physical reactions subscale; 20.7 ($SD = 7.99$) for peritraumatic dissociative experiences questionnaire; and 22.7 ($SD = 6.10$) for negative affect. And the number of traumatic events was 5.2 ($SD = 2.29$).

Peritraumatic dissociation and panic reactions were strongly associated with posttraumatic stress symptoms ($\beta = 5.0$, $p < 0.001$ and $\beta = 3.6$, $p < 0.001$, respectively), indicating that these reactions may be considered as confounders for the association between peritraumatic tonic immobility and PCL-C scores.

Table 1 shows raw and adjusted associations between peritraumatic tonic immobility and PCL-C scores. When analyzed without controlling for confounders, higher scores of tonic immobility were associated with higher scores of posttraumatic stress symptoms (step 1, $\beta = 4.8$, $p < 0.001$). After controlling for other peritraumatic reactions, negative affect, gender, time since trauma and type of trauma (step 5), the magnitude of the coefficient was reduced by almost 60% ($\beta = 1.99$), but the association remained statistically significant ($p = 0.017$).

Table 1 Regression parameters for the association between peritraumatic tonic immobility (independent variable) and PCL-C (dependent variable) scores, adjusted for different covariables (n = 198)

Models	Beta	95% CI	p-value
Step 1 Not adjusted	4.8	3.42-6.17	< 0.001
Step 2 Adjusted for PDEQ	2.87	1.25-4.50	0.001
Step 3* Step 2 plus NA	2.38	0.77-3.99	0.004
Step 4** Step 3 plus PRS	2.18	0.56-3.79	0.009
Step 5*** Final Model	1.99	0.36-3.62	0.017

* adjusted for PDEQ and NA
 ** adjusted for PDEQ, NA and PRS
 *** adjusted for PDEQ, NA, PRS, gender, time since trauma, and type of trauma.
 PDEQ: Peritraumatic Dissociative Experiences Questionnaire; NA: Negative Affect; PRS: Physical Reactions Subscale.

Discussion

As far as we know, this study was the first to show a significant association between peritraumatic tonic immobility and posttraumatic stress symptoms in a non-clinical sample experiencing various types of trauma. The importance of these results is two-fold: First, the study was conducted in a relatively healthy sample minimizing confounding factors such as comorbidities and medication. Second, peritraumatic tonic immobility predicts posttraumatic stress symptoms even after controlling for confounders, especially peritraumatic dissociation and peritraumatic panic reactions, which are well established risk factors for PTSD.

Studies using laboratory animal models revealed that although tonic immobility decreases the likelihood of being killed on the spot, it may have hazardous long-run consequences, including death in some cases.³⁹ In humans, peritraumatic tonic immobility in some contexts may increase the chances of survival,⁴⁰ while in others it may fail to be protective.⁴¹ Also, humans experiencing this reaction may exhibit unfavorable outcomes. Previous studies from our group in clinical samples showed that peritraumatic tonic immobility predicted both symptom severity and poor treatment outcome in PTSD patients.²⁷⁻²⁹ So it was not surprising to find that peritraumatic tonic immobility is a predictor of posttraumatic stress symptoms in a non-clinical sample. This finding implies that trauma victims who react with tonic immobility are at high risk for developing PTSD. Secondary prevention of PTSD is an important goal for public health. The present study suggests that screening for tonic immobility in the aftermath of a traumatic event may help to identify victims in need for early therapeutic intervention. Also, the present study adds evidence that the occurrence of

tonic immobility under traumatic events is far from rare in humans. Information about this involuntary defensive strategy to life-threatening events should be spread to the general public. Knowledge about this "natural" reaction has the power to alleviate shame and guilt of being immobile during a trauma.

This study has some limitations that need to be addressed. First, the retrospective design may have predisposed the participants to biased recall. Second, data were cross-sectional, thus precluding determination of whether peritraumatic tonic immobility reactions caused PTSD symptoms. Finally, trauma measures did not assess criterion A2 for PTSD (fear, helplessness, and horror in response to target events).

Conclusions

In summary, our data suggest that tonic immobility reaction is a relevant phenomenon for PTSD. Peritraumatic tonic immobility was significantly associated with posttraumatic stress symptoms in a non-clinical sample exposed to a variety of traumas, even after controlling for potential confounders.

Future research should employ multimodal assessment of peritraumatic tonic immobility reactions using laboratory tasks and psychophysiological measurements in order to further investigate its association with PTSD symptoms.

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Disclosures

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* Modest

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