

Brief report

## Is tonic immobility the core sign among conventional peritraumatic signs and symptoms listed for PTSD?

Vanessa Rocha-Rego <sup>a,\*</sup>, Adriana Fiszman <sup>b</sup>, Liana Catarina Portugal <sup>c</sup>,  
Mirtes Garcia Pereira <sup>c</sup>, Letícia de Oliveira <sup>c</sup>, Mauro V. Mendlowicz <sup>d</sup>,  
Carla Marques-Portella <sup>b</sup>, William Berger <sup>b</sup>, Evandro Silva Freire Coutinho <sup>e</sup>, Jair J. Mari <sup>f</sup>,  
Ivan Figueira <sup>b</sup>, Eliane Volchan <sup>a</sup>

<sup>a</sup> *Institute of Biophysics Carlos Chagas Filho, Universidade Federal do Rio de Janeiro (IBCCF-UFRJ), Brazil*

<sup>b</sup> *Institute of Psychiatry, Universidade Federal do Rio de Janeiro (IPUB-FRJ), Brazil*

<sup>c</sup> *Department of Physiology and Pharmacology, Universidade Federal Fluminense, Niterói, Brazil*

<sup>d</sup> *Department of Psychiatry and Mental Health, Universidade Federal Fluminense (MSM-UFF), Brazil*

<sup>e</sup> *Department of Epidemiology, Escola Nacional de Saúde Pública (ENSP-FIOCRUZ), Brazil*

<sup>f</sup> *Department of Psychiatry and Medical Psychology of the São Paulo Medical School, Universidade Federal de São Paulo (EPM-UNIFESP), Brazil*

Received 14 March 2008; received in revised form 29 August 2008; accepted 6 September 2008

Available online 8 October 2008

### Abstract

**Background:** Previous studies suggested the importance of peritraumatic reactions as predictors of PTSD symptoms severity. Despite mounting evidence that tonic immobility occurs under intense life threats its role as predictor of PTSD severity remains by and large understudied. The objective of this study was to investigate the role of peritraumatic reactions (tonic immobility, panic and dissociation) as predictors of PTSD symptoms severity.

**Methods:** Participants were 32 victims of urban violence with PTSD diagnosed through the SCID-I. In order to evaluate PTSD symptoms at baseline, we used the Post-Traumatic Stress Disorder Checklist — Civilian Version. To assess peritraumatic reactions we employed the Physical Reactions Scale, the Peritraumatic Dissociative Experiences Questionnaire and Tonic Immobility questions. As confounding variables, we considered negative affect (measured by the Positive and Negative Affect Schedule — Trait Version), sex and time elapsed since trauma.

**Results:** Tonic immobility was the only predictor of PTSD symptoms severity that kept the statistical significance after controlling for potential confounders.

**Limitations:** This study was based on a relatively small sample recruited in a tertiary clinic, a fact that may limit the generalizability of its findings. The retrospective design may have predisposed to recall bias.

**Conclusions:** Our study provides good reason to conduct more research on tonic immobility in PTSD with other samples and with different time frames in an attempt to replicate these stimulating results.

© 2008 Elsevier B.V. All rights reserved.

**Keywords:** Posttraumatic stress disorder; Predictor; Tonic immobility; Dissociation; Panic; Peritraumatic reactions

\* Corresponding author. Instituto de Biofísica Carlos Chagas Filho, Laboratório de Neurobiologia II, Av. Carlos Chagas Filho S/N, Ilha do Fundão, Rio de Janeiro, CEP: 21941-900, Brazil.

E-mail address: rochavr@biof.ufrj.br (V. Rocha-Rego).

## 1. Introduction

Although the etiopathogenesis of PTSD remains elusive, there is increasing evidence that several types of peritraumatic reactions play a significant role in predicting of PTSD symptoms. Peritraumatic dissociation, in particular, has been associated with the development of posttraumatic symptom in survivors of natural disaster (Koopman et al., 1994), combat veterans (Marmar et al., 1994; O'Toole et al., 1999; Tichenor et al., 1996), victims of motor vehicle accidents (Ursano et al., 1999) and physical trauma survivors (Michaels et al., 1999; Shalev et al., 1996). In fact, a recent meta-analysis (Ozer et al., 2003) showed that peritraumatic dissociation was the strongest predictor of the development of posttraumatic stress symptoms.

Lately, attention has been given to the role of peritraumatic panic reactions. Panic attacks are reported by more than half of trauma survivors during the traumatic experience (Nixon and Bryant, 2003). Lawyer et al. (2006) investigated peritraumatic dissociation, panic attacks and emotional reactions as predictors of PTSD in New York City residents during and in the immediate aftermath of the September 11th terrorist attacks and found that all three types of acute reactions were significant predictors of PTSD four months later.

Tonic immobility is an understudied type of peritraumatic response that has been observed mainly in victims of sexual abuse. Galliano et al. (1993) classified 35 female rape survivors into 3 groups (immobile, intermediate, and mobile) on the basis of self-reported degree of paralysis/freezing experienced during the sexual assault and found that 37% of participants had experienced complete immobility. Heidt et al. (2005) examined 80 adult females with a history of childhood sexual abuse and found that 42 individuals (52.5%) reported the occurrence of peritraumatic tonic immobility. More recently, Fiszman et al. (2008) found that peritraumatic tonic immobility was reported by 43% of a sample of victims of urban (i.e. mostly non-sexual) violence with PTSD. Additionally, peritraumatic tonic immobility was found to be associated with a poorer response to pharmacological treatment with antidepressants.

The aim of the present study was to compare the role of three types of peritraumatic response – tonic immobility, dissociation and panic reactions – as predictors of PTSD symptoms severity.

## 2. Method

### 2.1. Patients

Thirty-two patients with current PTSD were recruited from an outpatient university clinic specialized in posttraumatic stress assessment and treatment. Traumatic events included armed robbery ( $n=25$ ), motor vehicle accident ( $n=5$ ), attempted rape ( $n=1$ ), and burns ( $n=1$ ). After a complete description of the study to the volunteers, a written informed consent was obtained. Patients were evaluated by an experienced clinician (MVM) using the Structured Clinical Interview for DSM-IV Axis I Disorders (Del-Ben et al., 2001) to confirm the diagnosis of PTSD and to exclude cases of psychotic disorders, severe personality disorders, or significant cognitive impairment.

### 2.2. Measurements

This is a cross-sectional study. The severity of PTSD symptoms and the occurrence of three types of peritraumatic reactions were evaluated in a single session at the time of the patient's entry into the study, at a variable interval after the trauma occurred.

Peritraumatic dissociation was assessed using the Peritraumatic Dissociative Experiences Questionnaire (PDEQ) (Marmar et al., 1998; Fiszman et al., 2005). For each of the 10 items of the PDEQ, the subject was asked to rate in a 5-point Likert scale (1 = not at all true, 2 = slightly true, 3 = somewhat true, 4 = very true, 5 = extremely true) the extent to which he/she had experienced each dissociative phenomenon during or immediately after trauma exposure.

Peritraumatic physical symptoms of panic were evaluated through the Physical Reactions Subscale (PRS; Resnick et al., 1994). This scale is composed of 10 items, each one presenting a four-point Likert-type option [ranging from 1 (not at all) to 4 (extreme)] for the intensity of physical symptoms experienced during the traumatic event.

We employed the Tonic Immobility Scale (TIS-C; Heidt et al., 2005), a 10-item, seven-point Likert scale, to assess the occurrence of peritraumatic tonic immobility. Given that some of its items assess dissociative and panic-like responses and since the goal of this study was to compare the role of dissociative, panic, and tonic immobility reactions, we decided to exclude from our analyses the items of TIS-C that overlapped with those of the PDEQ and PRS. The main advantage of this procedure was to disentangle the strictly motor aspects

of tonic immobility from the other peritraumatic reactions under investigation.

We therefore adapted the following four items from the TIS-C (“questions 1, 2, 4 and 9a”) to be used in the present study: (i) rate the degree to which you froze or felt paralyzed during the event, (from 0 = not at all frozen or paralyze 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 = felt able to scream to 6 = felt like screaming but was unable); (iv) rate the extent to which you felt unable to escape during the event (from 0 = felt able to escape 6 = wanted to escape but remain “fixed”).

To support this procedure, we ran an exploratory factor analysis in a representative sample of 506 victims of urban violence in the city of Sao Paulo, Brazil. A three factor solution was extracted, with the above mentioned four “motor” items of the TIS-C forming the first factor, which accounted for 48% of the variance. Internal consistency of the “motor” subscale of the TIS-C was deemed satisfactory (Cronbach’s  $\alpha = .83$ ) (unpublished data).

PTSD symptoms severity was assessed using the Post-Traumatic Stress Disorder Checklist — Civilian Version (PCL-C) (Berger et al., 2004). The negative affect trait was measured by the Positive and Negative Affect Schedule — Trait Version (PANAS-T) (Watson et al., 1988). The PANAS is a 20-item scale consisting of 10 adjectives that describe negative and positive mood traits. Participants are asked to rate the degree to which they feel each emotion in general on a 1 (= very slightly or not at all) to 5 (= extremely).

### 2.3. Statistical analysis

All statistical analyses were carried out separately for each peritraumatic reaction. First, linear regression models were fitted to investigate the magnitude of the association of the three peritraumatic reactions (explanatory variables of interest) with PTSD symptoms (dependent variable). In order to control for potential confounders, multiple linear regression models were adjusted including the co-variables sex, time since trauma and negative affect. When the inclusion of a new variable in the model changed the magnitude of the coefficient of the peritraumatic reaction in more than 10%, this variable was considered a confounding factor for this association.  $p$ -values less than 0.05 were regarded as statistically significant, and those between 0.05 and 0.10 were considered borderline.

## 3. Results

The demographics and psychometrics characteristics of patients are presented in Table 1. The three peritraumatic reactions were associated with PTSD symptoms when evaluated separately (Table 2). When the association was controlled for sex, time elapsed since trauma and negative affect, the only variable that changed the magnitude of the association between peritraumatic reactions and PTSD symptoms by more than 10% was negative affect. The adjusted coefficients for the three reactions are depicted in Table 2. While tonic immobility maintained its association with PTSD symptoms, dissociation presented only a borderline significance, and panic reactions lost its statistical significance.

No interaction was observed between the peritraumatic variables and the co-variables negative affect, sex and time elapsed since trauma. All  $p$ -values for interaction terms were greater than 0.30.

## 4. Discussion

As far as we know, this study was the first one to compare the role of three types of peritraumatic response – tonic immobility, dissociation and panic reactions – as predictors of PTSD symptoms severity. We found that tonic immobility was the only variable

Table 1  
Patients with PTSD: socio-demographic and clinical characteristics.

Characteristics	<i>N</i>	%
Gender		
Women	13	41
Men	19	59
Education level		
Up to high school	27	84
At least some college	5	16
Relationship status		
Single	6	19
Married/living with partner	23	72
Divorced/separated/widower	3	9
	Mean	Standard deviation
Age	41	7.2
Time elapsed since trauma (in months)	27	41
Post-Traumatic Stress Disorder Checklist — Civilian Version	66	10.6
Tonic Immobility	12	7.9
Physical Reactions Scale	26	7.3
Peritraumatic Dissociative Experiences Questionnaire	23	10.0
Negative affect	32	9.8

Table 2  
Crude and adjusted association between peritraumatic reactions and PTSD symptoms.

Variables	Coef	SE	p-value
<i>Tonic Immobility</i>			
Crude	0.74	0.20	0.001 *
Adjusted for:			
Negative affect	0.57	0.19	0.004 *
Negative affect+sex	0.56	0.19	0.007 *
Negative affect+sex +time elapsed since trauma	0.57	0.20	0.008 *
<i>Peritraumatic Dissociative Experiences Questionnaire</i>			
Crude	0.41	0.18	0.032 *
Adjusted for:			
Negative affect	0.28	0.16	0.095
Negative affect+sex	0.30	0.16	0.080
Negative affect+sex +time since trauma	0.32	0.17	0.074
<i>Physical Reactions of Panic</i>			
Crude	0.59	0.24	0.020 *
Adjusted for:			
Negative affect	0.30	0.24	0.180
Negative affect+sex	0.27	0.25	0.285
Negative affect+sex +time elapsed since trauma	0.29	0.26	0.281

\*  $p < 0.05$ .

that kept the statistical significance after controlling for potential confounders.

Tonic immobility is widely found in the animal kingdom and considered a last-ditch defense against entrapment by a predator, within a sequence of defensive responses, namely freeze, flight, fight, and tonic immobility (Hennig, 1978; Rather 1967; Gallup et al., 1976; Bracha, 2004; Bracha et al., 2004, Marx et al., 2008). In humans, freezing-like reactions were recorded by somatic and autonomic measures in healthy subjects (Azevedo et al., 2005; Facchinetti et al., 2006). Immobility reactions to intense threats were investigated by psychometric screening in victims of sexual abuse (Galliano et al., 1993, Heidt et al., 2005, Marx et al., 2008) and in victims of urban violence (Fizman et al., 2008). Tonic immobility is known to occur in response to exposure to extremely frightening and inescapable situations. Given that PTSD is the psychiatric consequence of exposure to life threatening situation *par excellence*, it was not surprising to find that the occurrence of tonic immobility was a strong predictor of the severity of PTSD. Indeed, although tonic immobility decreases the likelihood of an animal being killed on the spot it may have hazardous short- and long-run consequences, including death, in a sizable proportion of cases (Gallup, 1977; Hofer, 1970; Liberson et al., 1961).

One of the strengths of the current study was the inclusion of negative affect trait as a confounding variable in the analysis. It is important to control for this variable given that negative affect trait was reported to be a risk factor for the development and for the severity of symptoms of PTSD (Miller, 2003).

Some limitations of the present study should be noted. It was based on a relatively small sample recruited in a tertiary clinic, a fact that may limit the generalizability of its findings. The retrospective design may have predisposed to recall bias. Nevertheless, our study provides good reason to conduct more research on tonic immobility in PTSD with other samples and with different time frames in an attempt to replicate these stimulating results.

#### Role of funding source

This research was partially supported by the CNPq (Nacional Research Council) through grant #420122/2005-2 (Projeto Milênio — Federal Government of Brazil). The CNPq had no role in the study design, in the collection, analysis and interpretation of data, in the writing of the report; and in the decision to submit the paper for publication.

#### Conflict of interest

All the authors declare that they have no conflicts of interest.

#### Acknowledgement

The authors would like to acknowledge Sonia Gleiser for administrative support.

#### References

- Azevedo, T.M., Volchan, E., Imbiriba, L.A., Rodrigues, E.C., Oliveira, J.M., Oliveira, L.F., Lutterbach, L.G., Vargas, C.D., 2005. A freezing-like posture to pictures of mutilation. *Psychophysiology* 42, 255–260.
- Berger, W., Mendlowicz, M., Souza, W., Figueira, I., 2004. Semantic equivalence of the Portuguese version of the Post-Traumatic Stress Disorder Checklist—Civilian Version (PCL-C) for the screening of post-traumatic stress disorder. *Rev. Psiquiatr. Rio Gd. Sul* 26, 167–175.
- Bracha, H.S., 2004. Freeze, flight, fight, fright, faint: adaptationist perspectives on the acute stress response spectrum. *CNS Spectr.* 9, 679–685.
- Bracha, H.S., Tyler, C., Ralston, M.A., Jennifer, M., Matsukawa, M.A., 2004. Does “fight or flight” need updating? *Psychosomatics* 45, 448–449.
- Del-Ben, C., Vilela, J., Hallak, J., Labate, C., Zuardi, A.W., 2001. Confiabilidade da “Entrevista Clínica Estruturada para o DSM-IV-Versão Clínica”. *Rev. Bras. Psiquiatr.* 23, 156–159.
- Facchinetti, L.D., Imbiriba, L.A., Azevedo, T.M., Vargas, C.D., Volchan, E., 2006. Postural modulation induced by pictures depicting prosocial or dangerous contexts. *Neurosci.Lett.* 410, 52–56.
- Fizman, A., Marques-Portella, C., Berger, W., Volchan, E., Oliveira, L.A.S., Coutinho, E.S., Mendlowicz, M.V., Figueira, I., 2005.

- Adaptação transcultural para o português do instrumento Peritraumatic Dissociative Experiences Questionnaire, Versão Auto-Applicativa. *Rev. Psiquiatr. Rio Gd. Sul*, 27, 151–158.
- Fizman, A., Mendlowicz, M.V., Marques-Portella, C., Volchan, E., Coutinho, E.S., Souza, W.F., Rocha, V., Lima, A.A., Salomão, F.P., Mari, J.J., Figueira, I., 2008. Peritraumatic tonic immobility predicts a poor response to pharmacological treatment in victims of urban violence with PTSD. *J. Affect. Disord.* 107, 193–197.
- Galliano, G., Noble, L.M., Travis, L.A., Puechl, C., 1993. Victim reactions during rape sexual assault — a preliminary-study of the immobility response and its correlates. *J. Interpers. Viol.* 8, 109–114.
- Gallup Jr., G.G., 1977. Tonic immobility: the role of fear and predation. *Psychol. Rec.* 27, 41–61.
- Gallup, G.G., Ledbetter, D.H., Maser, J.D., 1976. Strain differences among chickens in tonic immobility: evidence for an emotionality component. *J. Comp. Physiol. Psychol.* 90, 1075–1081.
- Heidt, J.M., Marx, B.P., Forsyth, J.P., 2005. Tonic immobility and childhood sexual abuse: a preliminary report evaluating the sequela of rape-induced paralysis. *Behav. Res. Ther.* 43, 1157–1171.
- Hennig, C.W., 1978. Tonic immobility in the squirrel monkey (*Saimiri sciureus*). *Primates* 19, 333–342.
- Hofer, M.A., 1970. Cardiac and respiratory function during sudden prolonged immobility in wild rodents. *Psychosom. Med.* 32, 633–647.
- Koopman, C., Classen, C., Spiegel, D., 1994. Predictors of posttraumatic stress symptoms among survivors of the Oakland/Berkeley, Calif., firestorm. *Am. J. Psychiatry* 151, 888–894.
- Lawyer, S.R., Resnick, H.S., Galea, S., Ahern, J., Kilpatrick, D.G., Vlahov, D., 2006. Predictors of peritraumatic reactions and PTSD following the September 11th terrorist attacks. *Psychiatry* 69, 130–141.
- Liberson, W.T., Smith, R.W., Stern, A., 1961. Experimental studies of the prolonged “hypnotic withdrawal” in guinea pigs. *J. Neuropsychiatr.* 3, 28–34.
- Marmar, C.R., Weiss, D., Metzler, T., 1998. Peritraumatic dissociative experiences questionnaire. In: Bremner, J.D., Marmar, C.R. (Eds.), *Trauma, Memory, and Dissociation*. American Psychiatric Press, Washington, DC, pp. 249–252.
- Marmar, C.R., Weiss, D.S., Schlenger, W.E., Fairbank, J.A., Jordan, B.K., Kulka, R.A., Hough, R.L., 1994. Peritraumatic dissociation and posttraumatic stress in male Vietnam theater veterans. *Am. J. Psychiatry* 151, 902–907.
- Marx, B.P., John, P., Forsyth, J.P., Gallup, G.G., Fusé, T., Lexington, J.M., 2008. Tonic immobility as an evolved predator defense: implications for sexual assault survivors. *Psychol. Sci. Pract.* 15, 74–90.
- Michaels, A.J., Michaels, C.E., Moon, C.H., Smith, J.S., Zimmerman, M.A., Taheri, P.A., Peterson, C., 1999. Posttraumatic stress disorder after injury: impact on general health outcome and early risk assessment. *J. Trauma* 47, 460–466.
- Miller, M.W., 2003. Personality and the etiology and expression of PTSD: a three-factor model perspective. *Clin. Psychol. Sci. Pract.* 10, 373–393.
- Nixon, R.D., Bryant, R.A., 2003. Peritraumatic and persistent panic attacks in acute stress disorder. *Behav. Res. Ther.* 41, 1237–1242.
- O’Toole, B.I., Marshall, R.P., Schureck, R.J., Dobson, M., 1999. Combat, dissociation, and posttraumatic stress disorder in Australian Vietnam veterans. *J. Trauma. Stress* 12, 625–640.
- Ozer, E.J., Best, S.R., Lipsey, T.L., Weiss, D.S., 2003. Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. *Psychol. Bull.* 129, 52–73.
- Rather, S.C., 1967. Comparative aspects of hypnosis. In: Gordon, J.E. (Ed.), *Handbook of Clinical and Experimental Hypnosis*. Macmillan, NY, pp. 550–587.
- Resnick, H.S., Falsetti, S.A., Kilpatrick, D.G., Foy, D.W., 1994. Associations between panic attacks and dissociative responses to rape. Paper Presented at the 10th Annual Meeting of the International Society of Traumatic Stress Studies. Chicago, IL.
- Shalev, A.Y., Peri, T., Canetti, L., Schreiber, S., 1996. Predictors of PTSD in injured trauma survivors: a prospective study. *Am. J. Psychiatry* 153, 219–225.
- Tichenor, V., Marmar, C.R., Weiss, D.S., Metzler, T.J., Ronfeldt, H.M., 1996. The relationship of peritraumatic dissociation and posttraumatic stress: findings in female Vietnam theater veterans. *J. Consult. Clin. Psychol.* 64, 1054–1059.
- Ursano, R.J., Fullerton, C.S., Epstein, R.S., Crowley, B., Vance, K., Kao, T.C., Baum, A., 1999. Peritraumatic dissociation and posttraumatic stress disorder following motor vehicle accidents. *Am. J. Psychiatry* 156, 1808–1810.
- Watson, D., Clark, L.A., Tellegen, A., 1988. Development and validation of brief measures of positive and negative affect — the PANAS scales. *J. Pers. Soc. Psychol.* 54, 1063–1070.