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Tonic immobility during sexual assault – a common reaction predicting post-traumatic stress disorder and severe depression

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Abstract

Introduction. Active resistance is considered to be the 'normal' reaction during rape. However, studies have indicated that similar to animals, humans exposed to extreme threat may react with a state of involuntary, temporary motor inhibition known as tonic immobility. The aim of the present study was to assess the occurrence of tonic immobility during rape and subsequent post-traumatic stress disorder and severe depression. *Material and methods.* Tonic immobility at the time of the assault was assessed using the Tonic Immobility Scale in 298 women who had visited the Emergency clinic for raped women within 1 month of a sexual assault. Information about the assault and the victim characteristics were taken from the structured clinical data files. After 6 months, 189 women were assessed regarding the development of post-traumatic stress disorder and depression. *Results.* Of the 298 women, 70% reported significant tonic immobility and 48% reported extreme tonic immobility during the assault. Tonic immobility was associated with the development of post-traumatic stress disorder (OR 2.75; 95% CI 1.50–5.03, $p = 0.001$) and severe depression (OR 3.42; 95% CI 1.51–7.72, $p = 0.003$) at 6 months. Further, previous trauma history (OR 2.36; 95% CI 1.48–3.77, $p < 0.001$) and psychiatric treatment history (OR 2.00; 95% CI 1.26–3.19, $p = 0.003$) were associated with the tonic immobility response. *Conclusions.* Tonic immobility during rape is a common reaction associated with subsequent post-traumatic stress disorder and severe depression. Knowledge of this reaction in sexual assault victims is important in legal matters and for healthcare follow up.

Abbreviations: ASD, Acute stress disorder; BDI, Beck Depression Index; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th edition; OR, odds ratio; PDS, Post-traumatic Stress Diagnostic Scale; PTSD, post-traumatic stress disorder; SASRQ, Stanford Acute Stress Reaction Questionnaire; SCID-I, Structured Clinical Interview for DSM-IV; TI, tonic immobility; TIS, Tonic Immobility Scale.

Introduction

Tonic immobility (TI) in animals has been considered an evolutionary adaptive defensive reaction to a predatory attack when resistance is not possible and other resources are unavailable (1). Far less is known about TI in humans. The legal system seeks visible signs of resistance because when it is absent, it is more difficult to prove a sexual assault (2). However, a substantial number of victims do not resist the attacker in any way (3). In humans, TI has been described as an involuntary, temporary state of motor inhibition in response to situations involving intense fear. It has been further described as a catatonic-

like state with muscle hyper- or hypo-tonicity, tremor, lack of vocalization, analgesia and relative unresponsiveness to external stimuli. Most studies on TI in humans have focused on sexual assault victims. This is probably because there is a postulated similarity between sexual assaults and predatory encounters (1). Sexual assault has also been described as one of the most traumatic experiences a person can be exposed to (4), and studies have shown that TI scores are significantly higher in victims of sexual abuse compared with other types of trauma (5). In these studies, significant immobility has been reported in 37% (6), 42% (7), and 52% of the sexual assault victims (8).

Along with other peritraumatic stress reactions, TI has been associated with the development of post-traumatic stress disorder (PTSD) (9–11). Lima and colleagues (10) showed that among victims of violence, TI predicted the severity of post-traumatic stress symptoms, as well as a poor response to treatment. Further, Bovin and colleagues (12) suggested that TI could be one path through which victims develop PTSD. Volchan and colleagues (13) suggested that patients with PTSD were more likely to experience TI during subsequent stress.

However, most studies on TI in humans have been retrospective (7–12,14). Further, earlier studies have been based on small sample sizes, making assumptions on causal relationships hazardous.

In the present study, we wanted to assess TI during rape in a large group of sexual assault victims at a follow-up appointment shortly after the emergency visit. We hypothesized that in screening a large clinical sample shortly after an assault, the experience of TI would be even greater than what has been found in earlier studies because it would reduce the possibility of a recall bias. Additionally, we wanted to explore the association between TI and the development of PTSD. In an earlier study (15) we found that the major risk factors for PTSD included having been sexually assaulted by a group, suffering from Acute Stress Disorder (ASD) shortly after the assault, having been subjected to several acts during the assault, having been injured and having a history of earlier traumatization. Therefore, we hypothesized that TI increases the risk of PTSD development, even after adjusting for these other known risk factors.

Material and methods

The study was performed at the Emergency Clinic for Raped Women in Stockholm, Sweden. In Stockholm all sexual assault victim care is centralized to this unit and the clinic is open 24 h a day. The clinic offers medical and forensic examination within 1 month of the sexual assault and services approximately 600 patients per year

after rape. All services are free of charge and independent of police reporting. At the time of the study, the clinic saw only female patients.

At a medical check-up appointment, approximately 10–14 days after the acute visit, all eligible women were asked to participate in the study. Women were found eligible if they were over the age of 18 years and were literate in Swedish. In addition, the consenting women needed to be able to participate in an interview that assessed PTSD symptoms and complete self-report questionnaires about their mental health. The participants were informed of the research procedure and risks, and they signed written consent.

Of 1047 eligible women, 317 female victims of rape or attempted rape, who had been in contact with the clinic between February 2009 and December 2011, agreed to participate in the study. Of these, 298 women completed the assessment regarding TI and 63% of the Post-traumatic came back for the 6-month visit, leading to a final sample of 189 women who were also assessed for the possible development of PTSD (15). Consenting women completed four self-rating questionnaires: Tonic Immobility Scale (TIS), Beck Depression Index (BDI), Post-traumatic Stress Diagnostic Scale (PDS), and Stanford Acute Stress Reaction Questionnaire (SASRQ). Information on any history of earlier sexual assaults, sexual assault in childhood, and the number of other earlier traumas were taken from the PDS questionnaire. Information regarding victim and assault characteristics were taken from the clinic's structured data files. Six months after the rape, study participants were assessed regarding PTSD using the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV; SCID-I), and they completed two of the self-rating questionnaires (BDI, SASRQ).

Measures

The Tonic Immobility Scale-Adult Form (TIS-A; 16), Part 1, is a 12-item questionnaire designed to assess the core features and components of TI. A Swedish version of the scale was used that had been translated using forward

> ## Key Message
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> Tonic immobility during rape is a common reaction, yet overlooked. In sexual assault victims, tonic immobility is associated with an increased risk of subsequent post-traumatic stress disorder and severe depression. Tonic immobility should be assessed in all sexual assault victims.

translation and then back-translated by an independent translator for control. The first 10 questions are answered using a seven-point Likert scale (range 0–6). To obtain the total score, the item scores are summed (Table 1). Higher scores in response to items 1–10 reflect greater TI behaviors. The TIS-A consists of two subscales: TTI (seven items) and Fear (three items) (7). The TI scale includes questions that assess various aspects of TI, such as feeling frozen or paralyzed, the inability to move although not restrained, the inability to call out or scream, numbness, feeling cold, fearing for one's life, and feeling detached from self (scores 0–42). The Fear subscale includes items that assess fear/panic, trembling/shaking and feelings of detachment from surroundings (scores 0–18). Using the same cut-off scores as earlier studies (7,8), a total score > 21 represented a significant TI and a total score $\geq$ 28 represented extreme TI. Symptoms of fear were considered clinically significant when a responder's total score on the Fear subscale was $\geq$ 9. In the present study the Cronbach's α was 0.87 for the whole questionnaire, 0.81 for the TI factor, and 0.62 for the fear factor.

The Beck Depression Inventory, BDI-II (17), includes 21 questions that measure depressive symptoms. The cut-off points for the sum scores were 0–13 (no depression), 14–19 (mild depression), 20–28 (moderate depression), and $\geq$ 29 (severe depression). Cronbach's α was 0.90.

The Post-traumatic Stress Diagnostic Scale, PDS (18) was used at baseline to assess the PTSD symptom score (0–51), a probable pre-existing PTSD diagnosis (using the DSM-IV criteria) and lifetime experience of traumatic events. PTSD was diagnosed at baseline when the respondent in PDS part 1 reported having been exposed to or witnessing a traumatic event that, according to PDS part 2, involved a threat to life or physical integrity; according to PDS part 3, having at least one re-experiencing symptom, at least three avoidance symptoms, and at least two arousal symptoms; that symptoms lasted for over 1 month; and according to PDS part 4, also caused impairment in the respondents' daily life in at least one area. Cronbach's α was 0.85.

The Stanford Acute Stress Reaction Questionnaire, SASRQ (19), was used at baseline and at the 6-month visit. The SASRQ is a 30-item self-report instrument with three additional questions relevant to the diagnosis of ASD. The instrument can be used as a Likert scale (0–5), where higher scores reflect greater symptoms, or dichotomously (0–2: 0, 3–5: 1), where 0 means absence and 1 means presence of a symptom. According to the DSM-IV, a diagnosis of ASD requires at least three of the five types of dissociative symptoms, one re-experiencing symptom, one avoidance symptom, one marked anxiety/increased arousal symptom, and impairment in at least one important area of functioning. We also used the SASRQ total score to measure the self-reported PTSD symptom severity over time. Cronbach's α was 0.90 for the whole questionnaire, which was good, and was 0.87 for the dissociation part.

The PTSD Module of the Structured Clinical Interview for DSM-IV (SCID-I) was used to establish current PTSD 6 months post-rape (20). The SCID-I is a widely used structured clinical interview. A diagnosis of full PTSD was made using the DSM-IV-TR (i.e. when clusters A and F were fulfilled).

Statistical analyses

Because most data were not normally distributed, comparisons between groups (TI vs. without TI) were performed using Mann–Whitney U test for continuous variables (age, dissociation score, depression symptom score, and PTSD symptoms score). Chi-square tests were used for categorical/dichotomized variables (marital status, relationship to assailant, earlier trauma, psychiatric treatment history, pre-existing PTSD, and assault characteristics). Risk factors for PTSD at 6 months were assessed as categorical variables using logistic regression. Variables were considered significant if the Wald test resulted in a p-value < 0.05. All statistical analyses were conducted using the statistical software version SPSS 22.0 (IBM Corp., Armonk, NY, USA).

Ethical approval

The study was approved by the regional medical ethics committee in Stockholm (2008/759-31).

Table 1. Tonic Immobility Scale, items used to compute the total score.

Rate the degree to which you/your:		Mean	SD
(1)	Froze or felt paralyzed during your most recent experience.	3.99	2.12
(2)	Were unable to move even though not restrained.	3.67	2.17
(3)	Body was trembling/shaking during the event.	3.17	2.19
(4)	Were unable to call out or scream during the event.	3.70	2.25
(5)	Felt numb or no pain during the event.	3.48	2.23
(6)	Felt cold during the event.	3.11	2.35
(7)	Felt feelings of fear/panic during the event.	4.57	2.02
(8)	Feared for your life or felt as though you were going to die.	3.06	2.36
(9)	Felt detached from yourself during the event.	4.37	1.98
(10)	Felt detached from what was going on around you during the event.	4.14	2.00

Table 2. Victim and assault characteristics between women with and without extreme tonic immobility during the sexual assault.

	With TI n = 142	Without TI n = 156	OR	95% CI
Age, years, median (range)	24.0 (17–59)	23.0 (18–59)	1.02	0.10–1.05
Marital status				
Unmarried/No partner	86 (60.6)	105 (67.3)	0.75	0.46–1.20
Married/Co-habitor	36 (25.4)	29 (18.6)	1.45	0.86–2.69
Partner/not living together	20 (14.1)	22 (14.1)	1.11	0.57–2.17
Earlier sexual assault	88 (62.0)	69 (44.5)	2.03**	1.28–3.23
Childhood sexual abuse	64 (45.7)	51 (32.9)	1.72*	1.07–2.75
History of ≥ 2 traumatic events	88(62.0)	64 (41.0)	2.36***	1.48–3.77
Psychiatric treatment history	79 (55.6)	60 (38.5)	2.00**	1.26–3.19
Penetrating assault	117 (83.0)	104 (66.7)	2.44**	1.41–4.23
Moderate or severe physical violence during assault	46 (32.6)	29 (18.7)	2.10**	1.23–3.59
Alcohol intake < 12 h before assault	99 (69.7)	126 (80.1)	0.51*	0.31–0.93
Relationship to assailant				
Acquaintance	73 (52.9)	77 (55.4)	1.10	0.70–1.74
Stranger incl. group	50 (36.2)	46 (33.1)	1.31	0.81–2.14
Partner	15 (10.9)	16 (11.5)	1.04	0.50–2.19
Amnesia	2 (1.4)	17 (10.9)	0.12**	0.03–0.52

CI, confidence interval; OR, odds ratio; TI, tonic immobility.
Data are given as Median (range) or n (%).
Pearson's chi-squared test for categorical variables and Mann–Whitney U test for continuous variables. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Results

The results from the TIS showed that 69.8% of the respondents reported significant immobility, and 47.7% reported extreme immobility during the sexual assault. Significant fear was experienced by 81.1% of the study population. The average total score for the 298 participating women was 37.3 (range 0–60; SD 14.6), with a mean TI subscale score of 23.4 (range 0–42; SD 10.8), and a mean Fear subscale score of 11.9 (range 0–18; SD 4.5). Descriptive statistics for all items are shown in Table 1. The mean number of days between the sexual assault and the completion of the TIS was 19.1 days (range 2–37; SD 6.7).

Victim and assault characteristics between the women with extreme TI during the assault and those without extreme TI are displayed in Table 2. Women with a previous history of sexual assault (in both childhood and adulthood) were twice as likely to report TI during the most recent assault. Additionally, a more severe assault (such as use of physical violence and penetrating assaults) was twice as likely to be reported in the TI group. Alcohol intake within the last 12 h before the assault was negatively associated with TI and reduced the risk of experiencing TI by half. No differences in TI were observed relative to victim–assailant relationships.

Further, women that had experienced TI were more than twice as likely to have pre-existing PTSD at the time of the assault, were more than three times likely to

present with ASD, and were more likely to have severe depression at the 2-week assessment (Table 3).

Finally, women who had experienced TI during the assault had higher psychiatric morbidity at the 6-month assessment in terms of both PTSD and depression (Table 4). Among the 189 women who completed the 6-month assessment, 38.1% had developed PTSD. Experiences of extreme TI [odds ratio (OR) 2.75; 95% CI 1.50–5.03, $p = 0.001$] and significant TI (OR 2.94; 95% CI 1.49–5.77, $p = 0.002$) during the assault were associated with PTSD development. Even after adjusting for the aforementioned known risk factors for PTSD and for whether a woman had a pre-existing PTSD diagnosis at the time of the assault or any other earlier psychiatric treatment history, TI was associated with PTSD development (adjusted OR 2.16; 95% CI 1.23–4.51, $p = 0.031$). Women who had experienced TI were also three times more likely to have severe depression after 6 months (OR 3.42; 95% CI 1.51–7.72, $p = 0.003$).

Discussion

The major finding of the present study was that the experience of TI during sexual assault is common. In this sample of women, 7 out of 10 reported significant immobility, nearly half reported extreme immobility, and 8 out of 10 reported significant fear during the sexual assault. To our knowledge, this study is the first to assess TI during sexual assaults in a large sample of women who

Table 3. Psychopathology at the two week assessment between women with and without extreme tonic immobility during the sexual assault.

	With TI n = 142	Without TI n = 56	OR	95% CI
Pre-existing PTSD[a] – n (%)	37 (26.1)	20 (12.8)	2.39**	1.31–4.36
Acute Stress Disorder[b] – n (%)	132 (93.0)	101 (65.6)	3.19***	1.78–5.68
Dissociation[b] – median (range)	36.0 (12–50)	29.0 (2–47)	1.10***	1.07–1.13
Severe depression[c] – n (%)	74 (52.1)	42 (26.9)	3.00***	1.85–4.87
Depression total score[c] – median (range)	30.7 (8–56)	21.0 (3–47)	1.07***	1.05–1.10

CI, confidence interval; OR, odds ratio; PTSD, post-traumatic stress disorder; TI, tonic immobility.
Pearson's chi-squared test for categorical variables and Mann–Whitney *U*-test for continuous variables. *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
[a]According to Post-traumatic Stress Diagnostic Scale (PDS).
[b]According to Stanford Acute Stress Reaction Questionnaire (SASRQ).
[c]According to Beck Depression Index (BDI).

Table 4. Psychopathology at the six month assessment between women with and without extreme tonic immobility during the sexual assault.

	With TI n = 84	Without TI n = 105	OR	95% CI
PTSD diagnosis[a] – n (%)	43 (51.2)	29 (27.6)	2.75**	1.50–5.03
PTSD total symptom score[b] – median (range)	98.5 (3–146)	70.0 (2–131)	1.05***	1.02–1.07
Severe depression[c] – n (%)	28 (33.7)	14 (13.6)	3.42**	1.51–7.72
Depression total score[c] – median (range)	21.0 (3–58)	12.0 (0–43)	1.05***	1.02–1.07

CI, confidence interval; OR, odds ratio; PTSD, post-traumatic stress disorder; TI, tonic immobility.
Pearson's chi-squared test for categorical variables and Mann–Whitney *U* test for continuous variables. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
[a]According to Structured Clinical Interview for DSM-IV (SCID).
[b]According to Stanford Acute Stress Reaction Questionnaire (SASRQ).
[c]According to Beck Depression Index (BDI).

sought medical care shortly after the assault. Earlier studies on TI during sexual assaults have been limited by small sample sizes and by a substantial time span having passed between the assault and the assessment. In these earlier studies, the frequency of TI was reported to be considerably lower than in our study, ranging from 37% (6) to 52% (8). A higher proportion of recall bias in the earlier retrospective studies, perhaps implying underreporting, may have caused this discrepancy.

The present study is also the first to prospectively examine the association between TI and the development of PTSD. Earlier studies have indicated an association between TI and PTSD, but the cross-sectional designs may have limited the possibility of generating causal relationships even more. In our study, we found that the PTSD prevalence at 6 months was almost twice as high in women who had experienced extreme TI compared with women who had not experienced TI during the assault (51% vs. 28%, $p = 0.001$). This association between TI and PTSD development remained after adjusting for the women who already had PTSD at the time of the assault and other known risk factors for PTSD (15).

Tonic immobility was associated with earlier trauma and pre-existing PTSD, which helps us better understand how cumulative trauma might work.

Both TI and ASD predicted PTSD 6 months after a rape. In future studies, peritraumatic phenomena in the form of TI and ASD may become treatment targets themselves, for example to focus directly on possible ways of reverting TI. It would also be interesting to replicate the present study by using the DSM-V criteria for ASD and PTSD because there may be differences in the predictive power of TI relative to the DSM-5 and the International Classification of Diseases, 10th revision.

This study also has some limitations that should be mentioned. The low participation rate could, of course, have caused a selection bias. A prospective design, however, involves approaching survivors in the acute aftermath of the assault, and it is only natural that many will not be willing to share details about the experience. The fact that almost 37% of the consenting patients were lost to follow up also represents a potential bias. However, the proportion of women by victim–assailant relationship was the same for the completers in this study as for the consecutive patients who sought help during the 13 months evaluated in another study from the same clinic (21), which suggests that our sample is representative for the patients at our clinic. In another earlier published study on the same study population (15), an attrition analysis showed that completers did not differ from non-completers in terms of victim and assault characteristics, except non-completers showed current alcohol abuse more frequently. Whether this is caused by simple forgetfulness, shame or other

factors remains unknown. Apart from non-completers being more depressed at baseline, they did not tend to score higher on the psychometrics at baseline compared with the completers. The only PTSD symptom cluster found significantly increased among the non-completers was the avoidance symptoms, which could explain the attrition. However, our results may still be biased by not having any information on women who did not seek any help. Further, the data collection was dependent on victims' answers to self-rating questionnaires, and it is not clear how reliable it is to collect data within the context of a visit shortly after a sexual assault because of peritraumatic dissociation. Some women did not recall or were unwilling to relate assault details.

The knowledge gained about the TI reaction has several implications. Legally, the courts may be inclined to dismiss the notion of rape because the victim did not appear to resist. Instead, what might be interpreted as passive consent is very likely to represent normal and expected biological reactions to an overwhelming threat. In addition, it becomes important in psychoeducation of rape victims to inquire about and explain such reactions because they might otherwise cause guilt or shame, which can exacerbate the trauma. The increased risk of PTSD and severe depression implies that psychiatric follow up is needed for these women.

Funding

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