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Prospectively predicting PTSD status with heart rate reactivity and recovery in interpersonal violence survivors

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ABSTRACT

The current study used heart rate (HR) reactivity to personalized trauma cues and HR recovery to predict later Posttraumatic Stress Disorder (PTSD) status in female interpersonal violence survivors. A scripted imagery paradigm was used to assess initial (M = 1 month posttrauma) HR reactivity during exposure to and recovery following idiographic trauma cues. In addition, follow-up PTSD status (M = 8 months posttrauma) was assessed with the Clinician Administered PTSD scale (CAPS). A logistic regression was used to predict PTSD status at the follow-up assessment with HR reactivity during exposure to a personalized trauma audio script and recovery periods at initial assessment entered hierarchically. Script HR reactivity alone did not significantly predict PTSD status. However, after adding HR recovery, the model was significant. Higher HR during recovery was significantly positively associated with PTSD-positive status while script HR reactivity remained a non-significant predictor. The model correctly classified 70% of cases with PTSD. A second logistic regression with initial CAPS severity as a covariate showed that HR recovery added predictive value beyond acute PTSD symptoms. These results suggest that HR recovery following trauma cue exposure is an important predictor of PTSD development.

1. Introduction

Heightened physiological reactivity is a core feature of Posttraumatic Stress Disorder (PTSD), a pervasive disorder that develops after exposure to a traumatic experience and is characterized by symptoms of re-experiencing, avoidance of trauma cues, and hyperarousal (American Psychiatric Association, 2000). Physiological hyper-reactivity, defined as the magnitude of response relative to baseline levels, has been observed in those with PTSD compared to those without, during exposure to both general trauma cues (Blanchard et al., 1994; Liberzon et al., 1999; Ehlers et al., 2010) and idiographic trauma cues (Orr et al., 1998). This finding is consistent across a variety of physiological outcomes, including heart rate (HR), skin conductance (SC), facial electromyography (EMG) and blood pressure (Shalev et al., 1992; Blanchard et al., 1994; Ehlers et al., 2010). While many researchers have examined this relationship concurrently, few have examined it prospectively and even fewer have examined this prospective relationship in female interpersonal violence survivors. A prospective design allows for identification of those at higher risk which would aid in allocation of limited resources to those who are most likely to benefit from treatment. While understanding physiological hyper-reactivity in PTSD does provide insight into changes in the nervous system, another important aspect that has received much less attention is how efficiently the nervous system recovers. This can be quantified as the speed or magnitude that an organism returns to baseline following response to trauma cues. Understanding this regulatory response will allow for more complete understanding of nervous system alterations in PTSD.

While the majority of trauma-exposed individuals experience high levels of symptoms immediately following the event, many recover within a few weeks. Rothbaum et al. (1992) found that in female rape survivors, PTSD and associated symptoms declined dramatically within the first month. Those whose diagnosis persisted three months posttrauma stopped improving after one month. For those who fail to recover, a two-factor conditioning model has been theorized in which, through classical and operant conditioning, trauma cues trigger an emotional and physiological response which is further reinforced through avoidance of these cues (Keane et al., 1985; Garakani et al., 2006). Failure to extinguish this fear response may contribute to later PTSD. In a review of factors predicting PTSD, Bryant (2003) posits that there is little agreement in acute symptoms across those who develop PTSD and that symptoms alone are not sensitive enough markers to discriminate who will develop PTSD. The author suggests that there is greater utility in focusing on how these symptoms interact with biological markers during the acute posttrauma phase. A meta-analysis of these physiological measures suggests HR reactivity is one of the most

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reliable physiological measures that discriminate trauma survivors who will go on to develop PTSD (Pole, 2007).

1.1. Contemporaneous HR reactivity and PTSD

To examine physiological reactivity to personalized trauma cues Pitman et al. (1987) adapted a script-driven imagery paradigm for use in a PTSD population, in which the participant aids in the creation of a personalized audio script. Several studies using this paradigm have demonstrated a contemporaneous relationship between PTSD diagnosis and elevated physiological reactivity to trauma cues (Pitman et al., 1987, 1990; Orr et al., 1993; Shalev et al., 1993).

1.2. Prospective HR reactivity and PTSD

Few studies have examined HR reactivity to cues using a prospective design. Blanchard et al. (1996) examined HR response to idiographic audio cues in motor vehicle accident survivors between one and four months post-accident and found that elevated HR predicted PTSD status one year later. Others have found similar relationships when assessing reactivity while talking about their trauma (O'Donnell et al., 2007) and viewing trauma related pictures (Suendermann et al., 2010). While elevated HR during trauma cue exposure has been demonstrated in PTSD, there are inconsistencies in the literature, with some researchers reporting no association between HR elevation and PTSD (Buckley et al., 2004) or even opposite findings (Blanchard et al., 2002; Halligan et al., 2006). This inconsistency suggests further research is needed to elucidate the link between HR reactivity and PTSD development.

1.3. HR reactivity and PTSD in female survivors

There is also limited prospective research examining HR as a predictor of PTSD in female interpersonal violence (IPV) survivors. Epidemiological studies have demonstrated a higher prevalence of PTSD in women (Davidson et al., 1991; Kessler et al., 1995) which is often attributed to the type of trauma women are more likely to experience but may be related to findings that women report greater subjective and physiological stress responses compared to men (Stoney et al., 1987; Kudielka et al., 2007). In a study of HR response to a scripted-imagery task two-weeks posttrauma, Kleim et al. (2010) found that HR reactivity was related to PTSD status six-months posttrauma but only in females, despite no sex differences in type, duration, or severity of assault. Women with high initial reactivity were more likely than women with lower reactivity and men, regardless of reactivity, to develop PTSD. This suggests that assessing reactivity as a factor in the subsequent development of PTSD may be especially important in women.

1.4. HR recovery in PTSD

While the primary focus on heightened physiological response within PTSD has been on reactivity to cues, this is not the only important physiological response. Successful nervous system adaptation depends not only on an appropriate increase of activity during times of stress but also an appropriate return to baseline once the threat is removed. In a comprehensive meta-analysis of the relationship between physiological factors and PTSD, Pole (2007) found that the most consistent relationship with PTSD status was, in fact, a measure of a regulatory process related to recovery: skin conductance habituation following presentation of startling sounds. Notwithstanding, few researchers have examined physiological recovery following exposure to trauma cues and those that have reveal mixed findings. Beckham et al. (2002) found that, compared to Vietnam veterans without PTSD, those with PTSD had significantly higher concurrent diastolic blood pressure but no differences in HR during the recovery period following an anger inducing situation. In a study of concurrent recovery HR and PTSD severity, Gutner et al. (2010) examined HR reactivity and recovery in physical and sexual assault survivors during and for five minutes immediately following a trauma narrative in which participants were prompted to talk about their traumatic event. They collected physiological measures and PTSD symptom scores at one and three-months post assault and found few significant associations between concurrent physiological measures and PTSD symptoms. At one-month posttrauma, neither HR reactivity nor HR recovery was significantly associated with PTSD symptoms after controlling for peritraumatic dissociation. Similar results were observed three-months posttrauma.

In addition to concurrent associations, Gutner et al. (2010) is one of the few studies to prospectively examine this relationship in females. At one-month posttrauma, HR reactivity during the narrative predicted reexperiencing symptoms, while recovery HR predicted reexperiencing and numbing symptoms three-months later. Neither predicted total severity, avoidance, or hyperarousal symptoms. Understanding the failure of HR recovery is important as it may be related to findings of increased risk for later development of cardiovascular dysfunction in those with PTSD (Gupta, 2013). Linking recovery HR to specific clusters or symptoms will help make clear the underlying mechanisms of how the nervous system becomes dysregulated in PTSD and whether this is a potential link between PTSD and subsequent health concerns.

1.5. Current study

The current study prospectively examines the relationship of HR reactivity and recovery during idiographic trauma cue exposure to subsequent PTSD development in a cohort of female IPV survivors. The majority of previous literature suggests a relationship between elevated HR reactivity and PTSD, therefore it is hypothesized that HR during script presentation will predict PTSD development. While there is less research on recovery, the most comparable study (Gutner et al., 2010) suggests it is predictive of some clusters of symptoms, it is hypothesized that HR recovery will also predict PTSD development but that reactivity will be a better predictor. We also test the relationship between avoidance and PTSD set forth by the two-factor conditioning model, and in accordance with this theory, it is hypothesized that initial avoidance symptoms will predict follow-up PTSD status.

2. Methods

2.1. Participants

This sample consisted of 62 female rape ($n = 11$) and first degree physical assault ($n = 51$) survivors. Initially, 114 participants were screened for assessment. Exclusion criteria included the presence of apparent psychosis ($n = 1$), illiteracy ($n = 0$) mental retardation ($n = 1$), intoxication at time of assessment ($n = 1$) and currently being in an ongoing violent relationship ($n = 1$). In addition, three participants chose not to participate after arriving and did not complete clinical or physiological assessments and 45 participants did not return for follow-up assessment. To be included in the current study, participants must have had at least clinical data at initial and follow-up assessments.

Participants were assessed for PTSD at the initial visit ($M_{months\ post\text{-}trauma} = 1.10$, $SD = 0.59$) and at follow-up ($M_{months\ posttrauma} = 8.72$, $SD = 6.40$; range = 5.3 − 38 months). All but five follow-up assessments took place between five and a half and 11 months posttrauma. The remaining follow-up assessments took place between 16 and 38 months posttrauma. No treatment was completed between assessments. Participants were recruited through St. Louis victim assistance agencies and local police agencies. The majority of participants were African American (71%) or Caucasian (24%). Eighty-four percent of participants were single, divorced, separated, or widowed and 16% were married or living with someone. Ages ranged from 18 to 77 ($M = 35.2$ years, $SD = 12.0$). Level of education was on average 12.5 years ($SD = 2.32$) and 62% of the sample reported an income level of less than