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Research report

Anxiogenic properties of a computer simulation for panic disorder with agoraphobia

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ABSTRACT

Background: There are several useful methods to induce anxiety in patients with panic disorder with agoraphobia (PDA). Our aim was to ascertain if a computer simulation (CS) could induce anxiety and physiologic alterations in PDA patients.
Methods: 10 healthy controls (HC) and 10 patients who fulfilled DSM-IV criteria for PDA were recruited for this study. The anxiety level was measured with the Subjective Units of Distress Scale (SUDS) and the Diagnostic Symptom Questionnaire (DSQ) was used to ascertain panic attack (PA) symptoms. The heart rate, skin conductance and respiration were monitored during exposure to the CS. The CS was a 3D computer animation of a short bus trip, from a first person perspective.
Results: In PDA patients CS exposure increased anxiety levels, they also had higher scores in the DSQ and two of them had PA. Compared to the HC, the PDA patients had higher skin conductance level, electrodermal response magnitude, respiratory rate, tidal volume, and respiratory rate irregularities. The heart rate means were higher for PDA patients who had PA, followed by HC and PDA patients who did not have PA. There were no significant differences between the two groups regarding the sense of presence.
Limitations: The main limitations were the small sample size, and some PDA patients under medications.
Conclusions: This study indicated that CS exposure may induce anxiety, electrodermal and respiratory alterations in patients with PDA. CS exposure may be a useful tool in the research and treatment of PD patients.

1. Introduction

There are several well documented biological methods to induce anxiety and panic attacks (PA) in panic disorder patients such as the carbon dioxide inhalation (Bystritsky et al., 2000a; Freire et al., 2008; Gorman et al., 1988; Papp et al., 1997), lactate infusion (Goetz et al., 1996; Liebowitz et al., 1975; Sinha et al., 2007) and administration of caffeine (Masdrakis et al., 2008; Masdrakis et al., 2009b; Nardi et al., 2007; Nardi et al., 2008). These methods are useful to test medications (Gorman et al., 1997; Perna et al., 2002), and investigate de panic disorder connection with respiration (Masdrakis et al., 2009a; Nardi et al., 2006; Niccolai et al., 2008). The exposure in vivo (Ost et al., 2004), with imagery (Bystritsky et al., 2000b) and with virtual reality (VR) (De Carvalho et al., 2008) are cognition mediated techniques that can induce anxiety in patients with panic disorder with agoraphobia (PDA). The imagery exposure may not be strong enough to evoke anxiety about specific situations (Bystritsky

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et al., 2000b) and investigators found difficulties sustaining a clear frightening image in panic subjects (Cuthbert and Lang, 1989). Compared to imagery the in vivo exposure is a much more powerful anxiety-provoking stimulus (Bystritsky et al., 2000b), nevertheless there are several limitations in the use of this method in research (Botella et al., 2004; Bystritsky et al., 2000b). On the other side, the virtual reality environments become more realistic day by day and are fully controllable to the investigator (Botella et al., 2004). Despite new developments, a large portion of VR potential regarding the research of PDA is still unexplored (De Carvalho et al., 2008).

Our objective was to verify if a given computer simulation (CS) with a bus in a tunnel situation would induce anxiety, panic attacks and other psychophysiological reactions in PDA patients.

2. Methods

2.1. Subjects

We randomly selected a sample with 10 patients with panic disorder and agoraphobia, who were in treatment in the Laboratory of Panic and Respiration at the Institute of Psychiatry of the Federal University of Rio de Janeiro. They were interviewed with the M.I.N.I. 5.0 (Amorim, 2000; Sheehan et al., 1998) and fulfilled DSM-IV (APA, 1994) criteria for PDA. The inclusion criteria were: 18 to 65 years of age, and occurrence of at least two panic attacks in a 30-day period before the visit. Patients with comorbid dysthymia, generalized anxiety disorder or depression were included only if PDA was judged to be the primary diagnosis. Some of them were to begin the treatment and unmedicated, while others were already taking antidepressants or benzodiazepines. There was also a control group with 10 people who were interviewed with the M.I.N.I. 5.0 (Sheehan et al., 1998) and did not fulfill criteria for any psychiatric disorder. Subjects with other psychiatric disorders, neurological, cardiologic or respiratory diseases were not included in this study. Our local Ethics Committee approved the protocol, which complied with the principles of the Declaration of Helsinki. After the experiment was fully explained the subjects signed a voluntary written consent.

2.2. Scales

In the initial evaluation the severity of anxiety, depression, panic disorder and agoraphobia symptoms were measured with the: Panic Disorder Severity Scale (PDSS) (Shear et al., 1997), Beck Anxiety Inventory (BAI) (Beck et al., 1988), Beck Depression Inventory (BDI) (Beck et al., 1979), Agoraphobic Cognitions Questionnaire (ACQ) (Chambless et al., 1984) and Mobility Inventory (MI) (Chambless et al., 1985). The Subjective Units of Distress Scale (SUDS) (Bech et al., 1986) was administered before the experiment. After the exposure the SUDS was administered again along with the Diagnostic Symptom Questionnaire (DSQ) (Sanderson et al., 1989) and the Igroup Presence Questionnaire (IPQ) (Schubert et al., 2001). The SUDS is a semi quantitative evaluation method with scores ranging from 0 (no anxiety) to 10 (maximum anxiety), and the DSQ is a scale to measure the presence and level of discomfort of panic attack symptoms, and each symptom is rated from 0 to 4 points (0 = none, 4 = very severe). The IPQ is a 13-item scale used to measure the sense of presence in a virtual environment. People who are present in a virtual environment have the experience of actually being in the virtual place, they focus their attention on that environment and they experience it as somehow real (Schubert et al., 2001).

When the subjects rated in the DSQ four or more panic attack symptoms with moderate intensity, and at least one of the cognitive symptoms (e.g., fear of dying, losing sanity or control) they were considered as having a panic attack (Nardi et al., 2008).

3. Material

The equipment used to measure physiologic variables were Biopac MP100 with AcqKnowledge software, from Biopac Systems Inc. (www.biopac.com), a respiratory effort transducer, EKG electrodes and skin conductance electrodes. The CS was displayed in a regular computer screen and headphones were used.

In the analysis of the skin conductance the parameters used were the skin conductance level (SCL), number of electrodermal responses (NER) and electrodermal response magnitude (ERM), which is the mean amplitude of the electrodermal responses during a given period. Regarding the cardiac monitoring, only the heart rate (HR) was measured. The parameters for respiration were respiratory rate (RR) and thorax expansion (TE), which is a correlate of the tidal volume. To facilitate the comparisons between subjects the SCL and TE were standardized in a percentage of the baseline (first gray screen) measure of each subject. To measure irregularities in the RR and in the TE the von Neumann statistic (Neumann, 1941) was used in a similar way as Abelson et al. (2001a) did. This statistic is the sum of squared differences between successive breaths, divided by the number of differences summed. By the use of this statistic tool two new variables were created: the respiratory rate irregularity (RRI) and the thorax expansion irregularity (TEI). The means of all these physiological variables were calculated in eight 30-second periods.

The simulation was a 4-minute three-dimensional computer animation developed by TriptyqueLAB (www.triptyquelab.com). Included in this animation there were two 30-second periods in which a gray screen was displayed, one before and the other after the animation per se. The animation was in a first person perspective and there was a camera movement as if the subject was walking and looking at different directions. The animation starts at a bus stop, the bus arrives, the subject gets in and sits on the bus, the bus moves through city streets, stops again, is filled with people, moves through the streets, gets in a tunnel, stops inside the tunnel because of the traffic, starts moving again, leaves the tunnel, stops at a bus stop, the subject gets out of the bus and watches the bus go away (Figs. 1 and 2). The simulation included sound, which was basically ordinary street noises associated with the images.

3.1. Procedure

Before CS exposure the subjects were instructed that the animation was about an agoraphobia-related situation and