Stress-related symptoms and positive emotions after a myocardial infarction: a longitudinal analysis

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Background: There is a controversy as to whether the diagnostic umbrella of post-traumatic stress reactions is directly applicable to serious health conditions like myocardial infarction (MI).

Objective: The principal objective of this study was to examine longitudinally the prevalence of posttraumatic stress-related symptoms, throughout three measurement periods, for patients who had suffered a first MI. In addition to the analysis of symptoms related to stress and general distress, the presence of and temporary evolution of positive emotions and optimism in these patients was also evaluated.

Design: A longitudinal study with three periods of evaluation after the MI (Time 1 (T1): 48–72 hours, Time 2 (T2): 5 months, and Time 3 (T3): 13 months).

Results: In T1 few symptoms related to the stressful event were found. The probable prevalence of PTSD was 8–11% at 5 months after the MI and 0–3% 13 months after the event. With regard to subjective severity of the infarction, although in the first instance patients did not regard the event as excessively traumatic, in the periods T2 and T3 this perception increased significantly \( F(2, 32) = 20.00; p = 0.0001 \). At all times during the measurement period the mean positive affect was significantly greater than the negative affect.

Conclusions: As the results show, the probable prevalence of PTSD, as well as the severity of different symptom clusters, is low at all times of the evaluation. The diagnostic implications of these findings are discussed as well as the uses and abuses of diagnostic labels to characterize the psychological experiences lived through after a potentially life-threatening health problem.

Keywords: trauma; positive emotions; health; infarction; PTSD; PCL-C

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first MI. In the case of patients who have suffered several incidents, the levels oscillate between 4% (Rocha et al., 2008) and 30% (Chung, Berger, Jones, & Rudd, 2006).

In the case of MI, as with other traumatic events, the subjective perception of the seriousness of the event is very relevant, more so than the objective threat of the cause of stress. In fact, Ginzburg et al. (2003) observed that the perceived severity, rather than the objective seriousness of MI, can predict the onset of a posterior PTSD.

Although the impact of myocardial infarct on psychopathological problems (e.g., depression, disability, etc.) has received some attention in the last years, much less is known on the presence and the role of positive emotions that can coexist with that condition. This perspective is also important as there is sound evidence that positive psychological states are associated with improved health outcomes and lower morbidity (Lyubomirsky, King, & Diener, 2005; Pressman & Cohen, 2005). For example, happy individuals cope better with breast cancer (Peled, Carmil, Siboni-Samoacha, & Shoham-Vardi, 2008), or stroke (Ostir, Markides, Peek, & Goodwin, 2001). In addition, longitudinal studies have shown that positive emotions reduce mortality in AIDS patients (Moskowitz, 2003) and reduce all-cause mortality in prospective cohort studies (Giltay Geleijnse, Zitman, Hoekstra, & Schouten, 2004; Koopmans, Geleijnse, Zitman, & Giltay, 2010; Xu & Roberts, 2010).

All these data demonstrate the importance of a comprehensive investigation of reaction to MI. The objective of our study was double. Firstly, we have seen that the majority of existing studies is of a cross-sectional nature (see Table 1), which provide little information regarding directionality and time patterns. Moreover, the longitudinal studies that exist have only two time-measurement periods, which impedes a clear vision of

### Table 1. Studies of the prevalence of PTSD in patients with myocardial infarction (MI)

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Medical diagnosis</th>
<th>Evaluation of PTSD</th>
<th>Assessment time</th>
<th>Probable prevalence, % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kutz et al. (1994)</td>
<td>100</td>
<td>MI</td>
<td>PTSD inventory</td>
<td>6-18 months</td>
<td>25% (9)</td>
</tr>
<tr>
<td>Doerfler et al. (1994)</td>
<td>50</td>
<td>MI or bypass</td>
<td>RI + algorithm based on DSM III-R</td>
<td>6 months</td>
<td>8% (4)</td>
</tr>
<tr>
<td>Van Driel et al. (1995)</td>
<td>23</td>
<td>First MI</td>
<td>SCID-R</td>
<td>22-26 months</td>
<td>4% (1)</td>
</tr>
<tr>
<td>Bennett et al. (1999)</td>
<td>44</td>
<td>MI</td>
<td>PDS</td>
<td>6-12 months</td>
<td>10.75% (4)</td>
</tr>
<tr>
<td>Bennett et al. (2001)</td>
<td>70</td>
<td>First MI</td>
<td>PDS</td>
<td>3 months</td>
<td>3% (3)</td>
</tr>
<tr>
<td>Shemesh et al. (2001)</td>
<td>102</td>
<td>Recent MI</td>
<td>IES</td>
<td>6 months</td>
<td>9.8% (10)</td>
</tr>
<tr>
<td>Bennett et al. (2002)</td>
<td>89</td>
<td>MI</td>
<td>PDS</td>
<td>3 months</td>
<td>16%</td>
</tr>
<tr>
<td>Ginzburg et al. (2003)</td>
<td>116</td>
<td>MI</td>
<td>PTSD Inventory + DSM-IV</td>
<td>T1: 4 days (ASD)</td>
<td>T1: 18% (21)</td>
</tr>
<tr>
<td>Pedersen et al. (2004)</td>
<td>T1: 112</td>
<td>First MI</td>
<td>PDS</td>
<td>T2: 7 months</td>
<td>T2: 16% (18)</td>
</tr>
<tr>
<td>Shemesh et al. (2004)</td>
<td>T2: 102</td>
<td>MI</td>
<td>IES</td>
<td>T1: 4-6 weeks</td>
<td>T1: 24% (25)</td>
</tr>
<tr>
<td>O’Reilly et al. (2004)</td>
<td>54</td>
<td>MI with or without SCA</td>
<td>SCID, PDS, IES</td>
<td>T2: 9 months</td>
<td>T2: 14%</td>
</tr>
<tr>
<td>Chung et al. (2006)</td>
<td>96</td>
<td>MI</td>
<td>PDS</td>
<td>&gt; 1 months</td>
<td>30%</td>
</tr>
<tr>
<td>Rocha et al. (2008)</td>
<td>31</td>
<td>MI</td>
<td>SCID</td>
<td>1-2 months</td>
<td>4% (1)</td>
</tr>
<tr>
<td>Hari et al. (2010)</td>
<td>274</td>
<td>MI</td>
<td>PDS</td>
<td>T1: 60 days; T2: 32 mo</td>
<td>T1: 19.0% (52); T2: 10.2% (28)</td>
</tr>
</tbody>
</table>

Notes: ASD, Acute Stress Disorder; PDS, Posttraumatic Diagnosis Scale (Foa, 1995); IES, Impact of Event Scale (Horowitz et al., 1979); RI, Reaction Index (Frederick, 1985); SCID, Structured Clinical Interview (First et al., 1997); SCA, Sudden Cardiac Arrest.
the variables over a period of time. Secondly, we have completed the evaluation of reaction to a MI with the inclusion of measurement of positive emotions and subjective measurement of the trauma, which provides a fuller understanding of the experience.

Measures
Within a more extensive protocol, some of the instruments used in the three stages of the evaluation (T1, T2, and T3) were:

1. **The PTSD Checklist (PCL-C)** (Weathers, Litz, Herman, Huska, & Keane, 1993). This questionnaire evaluates, on a scale of 1 to 5, the severity of the 17 symptoms covering the criteria B (Re-experiencing), C (Avoidance), and D (Hyperarousal) of the DSM-IV (APA, 1994) for Post Traumatic Stress Disorder. The Cronbach’s alpha values in our study were 0.80 (Total score), 0.69 (Re-experiencing), 0.68 (Avoidance), and 0.62 (Hyperarousal).

The PCL-C scores were used in two different ways. First, in order to determine the probable prevalence of PTSD, we implemented the criterion most used in the literature (i.e., total score >44; Blanchard et al., 2004). Second, in order to verify the percentage of participants likely to have separate symptom clusters (i.e., criteria B, C, and D of the DSM-IV-TR (APA, 2000) for PTSD), the percentage of participants meeting each criterion of the PCL-C was analyzed. We considered the criteria met (see Vázquez, Pérez-Sales, & Matt, 2006) if the participant had a severity rating of 4 or more on the 5-point Likert scale in the minimum number of symptoms required for each criterion of the DSM-IV-TR (i.e., one of the five for Re-experiencing, three of the seven for Avoidance, and two of the five for Hyperarousal).

2. **Perceived importance of the heart failure.** Three items on a 1–10 Likert-type scale were used, referring to a subjective reaction to the MI: perception of danger (“Did you feel that your life was in danger?”), if the situation was traumatic for the patient (“Would you describe the event as traumatic for you?”) and perception of the severity of the situation (“To what point would you describe what has happened to you as severe?”).

3. **Goldberg Health Questionnaire (GHQ-12)** (Goldberg & Williams, 1996). The objective of this questionnaire, widely used in epidemiological studies in the general population, is to evaluate general distress. It consists of 12 items with 4 request options on a Likert-type scale. As some authors have proposed recently (Hu, Steward-Brown, Twigg, & Weich, 2007), the scoring can be divided by separately taking into account the six items that evaluate a state of “positive mental health” (e.g., “Have you been able to concentrate on things?”) and the six items that evaluate a state of negative mental health or general distress (e.g., “Did you feel constantly under strain?”). The Cronbach’s alpha values were...
0.65 (GHQ-12), 0.51 (GHQ-6: Positive mental health), and 0.74 (GHQ-6: General distress).

(4) **Life Orientation Test — Revised** (LOT-R, Scheier, Carver, & Bridges, 1994). The test measures dispositional optimism or the generalized predisposition towards the expectation of positive results. It consists of six specific items of which three evaluate optimism and three evaluate pessimism. Participants rate their answers on a scale of 1–5 (Cronbach’s alpha = 0.74). An additional item was added, in the same answer format, which specifically asked about the patient’s expectations with regard to a complete recovery from the infarction (“I believe I’m going to come out of this heart problem I have completely fine”).

(5) **Positive and Negative Affect Schedules** (Watson, Clark, & Tellegen, 1988). The PANAS is a widely used instrument for measuring affect by means of a listing of 20 emotions (10 positive and 10 negative). The replies range from 1 to 5 according to the intensity of the emotion. The Cronbach’s alpha values were 0.84 for the positive subscale and 0.82 for the negative subscale.

**Design**
The design of this study was longitudinal with 3 points of evaluation. Repeated measures ANOVAs were conducted to assess changes in all the measures across times.

**Results**

**Characteristics of the sample**
Table 2 presents the data obtained in each of the questionnaires of the evaluation protocol.

In the first place, a series of repeated measures ANOVAs revealed no significant time differences on participants’ scores on PCL total score [$F(2, 29) = 2.29$, $ns$] and on two subscales: PCL-Re-experiencing [$F(2, 31) = 2.69$, $ns$] and PCL-Avoidance [$F(2, 29) = 0.45$, $ns$]. Nevertheless, significant differences were encountered in the scale of Hyperarousal [$F(2, 31) = 3.66$, $p = 0.038$]. A post-hoc Bonferroni analysis showed that Hyperarousal was significantly greater in T2 than in T1 ($p < 0.044$). Yet, as it can be shown in Table 2, the overall scores for each subscale were, in general, very close to the minimum possible level of severity.

With regard to the assessment of the perceived importance of the event, a repeated-measures analysis showed a significant time effect for “Traumatic Event” [$F(2, 32) = 20.00$, $p = 0.0001$]. Post-hoc Bonferroni tests showed that participants assessed their heart attacks significantly less ‘traumatic’ at baseline (T1) than 5 months later (T2) or 13 months later (T3); there were no differences between T2 and T3. Mean scores of this variable were close to the maximum possible score both at T2 ($M = 8.76$) and T3 ($M = 8.97$) (see Table 2). Two additional ANOVAs on the perception of “life at risk” and having a “perception of severity” did not show time effects. Yet, participants’ perception of these two variables was remarkably different. Mean score for “life at risk” was significantly lower than that of “perception of severity” at any time of measurement: T1: $[t(31) = -3.45; p = 0.002]$; T2: $[t(32) = -5.89; p = 0.0001]$; T3: $[t(31) = -7.27; p = 0.0001]$.

Regarding the scores in the GHQ-12, we ran a 3 x 2 ANOVA (Time x Positive/Negative mental health), which only yielded significant results for the Positive/Negative factor [$F(2, 33) = 45.90; p = 0.0001$]. Positive mental health scores were higher than negative mental health scores (i.e., general distress) at any time of assessment: T1: $[t(29) = 7.06; p = 0.0001]$; T2: $[t(30) = 5.19; p = 0.0001]$; T3: $[t(31) = 8.35; p = 0.0001]$.

In regard to positive and negative emotions, we ran a 3 x 2 repeated measures ANOVA on the PANAS scores (Time x Positive/Negative affect), which only yielded a main effect for Positive/Negative affect [$F(16) = 26.90; p = 0.0001$]. Furthermore we found that the levels of positive affect were greater than those of negative affect in the three evaluations carried out at T1 $[t(31) = 6.49; p = 0.0001]$, T2 $[t(18) = 3.51; p = 0.002]$, and T3: $[t(31) = 8.37; p = 0.0001]$.

Finally, a series of one-way ANOVAs on dispositional optimism (i.e., LOT-R) and optimism on a full recovery from the heart problem showed that there were no changes in scores of both measures across the three times of measurement [$F(2, 29) = 0.26$, $ns$ and $F(2, 29) = 0.73$, $ns$, respectively]. Furthermore, as can be seen in Table 2, scores on both types of optimism, as well as in the rest of measures of positive affect, were consistently high across time.

**Prevalence of post-traumatic stress symptoms**

As can be seen in Table 3, using a cut-off score of PCL-C > 44, the probable prevalence of significant stress reaction in T1 is very low, rising to a prevalence of 11.1% after 5 months. Finally, the number of cases with probable diagnoses of PTSD declines 13 months after the event (3.1%).

In regard to the prevalence of specific syndromes (see Measures section), it was found that, at each point of measurement, Re-experiencing was the criterion that appeared in the greatest number of participants while the criterion of Avoidance was that of least prevalence in the patients evaluated (Table 3). The progression of the three steps over time was similar: the moment at which most subjects met the criteria was at five months after the MI, while mitigating later.

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1Using a more restrictive criterion (i.e., total score > 50; Schlenger et al., 2002), the results were almost identical.
Discussion

The sudden and brusque occurrence of a MI is a potentially serious and life-threatening condition. It is interesting that, during the first few days, the heart attack was not considered to be a highly “traumatic” event by the participants but, 5 months and 13 months after the MI, it was considered so. Nevertheless, this perceived severity and the perception of the event as traumatic did not correspond to a grand estimation that one’s life was in danger. Probably, the fact that the patient was treated rapidly and clinically stabilized in a safe, hospital environment, leads to a weakening of the perception of risk, which in turn can explain the relatively low prevalence of symptoms related to stress encountered in this study and in studies of similar design (Bennett et al., 2001). It is likely that rapid medical intervention and hospitalization may prevent people from developing intense sensations of horror or despair, which can be considered a necessary prerequisite for the diagnosis of PTSD and a strong predictor of the severity of this condition (Brewin, Andrews, & Rose, 2000).

Table 2. Characteristics, in the three times of assessment, of the sample who completed all the follow-ups (n = 33)

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Sd</td>
<td>M</td>
</tr>
<tr>
<td>Total score</td>
<td>22.67</td>
<td>5.13</td>
</tr>
<tr>
<td>Re-experiencing</td>
<td>6.64</td>
<td>2.33</td>
</tr>
<tr>
<td>Avoidance</td>
<td>8.94</td>
<td>2.41</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>7.09</td>
<td>2.75</td>
</tr>
</tbody>
</table>

Perception of the event

| Traumatic event | 4.33 | 3.38 | 8.76 | 2.21 | 8.97 | 2.53 |
| Life at risk | 4.69 | 3.52 | 4.09 | 3.32 | 3.53 | 2.86 |
| Perception of severity | 7.03 | 2.60 | 7.33 | 2.84 | 7.09 | 2.56 |

Psychological measures

| GHQ12 (Total) | 11.63 | 4.94 | 11.61 | 6.85 | 10.50 | 5.08 |
| GHQ6 (Positive health) | 11.41 | 1.63 | 10.84 | 2.79 | 11.28 | 1.65 |
| GHQ6 (General distress) | 4.96 | 4.29 | 4.34 | 4.45 | 3.78 | 3.98 |
| Optimism (LOT-R) | 11.22 | 3.33 | 11.67 | 3.09 | 11.16 | 3.51 |
| Optimism about recovery | 4.19 | 1.2 | 4.24 | 1.06 | 4.47 | 1.04 |
| Positive affect (PANAS) | 29.25 | 9.24 | 29.47 | 8.17 | 34.75 | 11.15 |
| Negative affect (PANAS) | 17.00 | 7.44 | 19.05 | 10.14 | 17.31 | 8.24 |

Table 3. Probable prevalence of PTSD based on a selected cutoff score for the PTSD Checklist (PCL-C) and percentage of patients fulfilling criteria for each of the three symptom clusters

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 76</td>
<td>n = 48</td>
<td>n = 33</td>
</tr>
<tr>
<td>Probable PTSD</td>
<td>1.4</td>
<td>11.1</td>
</tr>
<tr>
<td>PCL-Total score &gt; 44</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Symptom clusters</td>
<td>18.4</td>
<td>25.0</td>
</tr>
<tr>
<td>Re-experiencing</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Avoidance</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Hyperarousal</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>
positive emotions experienced during and after the trauma may have an important role in the attenuation of psychopathological problems (Vázquez & Hervás, 2010). The pattern of results of our study reveals that, in general, a myocardial infarct, with adequate medical treatment, has a relatively minor effect on the appearance of psychopathological symptoms related to posttraumatic stress. This corresponds also with the low prevalence of psychopathology found in previous studies (Ginzburg et al., 2003; Hari et al., 2010) and even in medical problems such as cancer (Shelby, Golden-Kreutz, & Andersen, 2008). The results obtained with regard to the prevalence of probable cases of PTSD in our sample are consistent with those found in the literature. We found 11.1% of probable cases at 5 months from the MI and 3.1% at one year following the event. In similar studies, with first-time MI patients and with a comparable measurement period, for example, levels of PTSD of 9.8% are found at 6 months, (Shemesh et al., 2001). Although it is difficult to compare our results with other longitudinal studies, due to the fact that none have three measurement periods, and none coincide with regard to the time between measurements, published studies usually show this decrease in the prevalence of PTSD over a period of time (Ginzburg et al., 2003; Pedersen et al., 2004). In a more general manner, the findings of our study corroborate that most people show resilience in adverse situations (Wessely, 2004). Studies of the general population indicate that whereas “traumatic events,” as defined in DSM-IV, may affect more than 50% of the general population in the course of their lives (Breslau, Davis, & Andreski, 1995; Darves-Bornoz et al., 2008), only 1–3% (5–15%, if the less severe forms are included) will show PTSD (Alonso et al., 2004; Kessler et al., 1995). In the case of physical illnesses, the “European Study of the Epidemiology of Mental Health” showed, in a sample of 8,796 subjects from the general population, that while 10% of the sample had suffered a serious illness, only 2% of these patients had developed PTSD as a result of that illness (Darves-Bornoz et al., 2008).

The study, nevertheless, has some limitations. In the first place, although the initial number of participants was relatively high, various conditions (including a high death rate) decreased the resulting final sample. However, as has been explained above, the analyses revealed that the final samples of the study in T2 and T3 did not differ significantly from the initial sample either in socio-demographic (age, sex, socio-economical level...) or psychopathological variables. Secondly, it is possible that the evaluation of the symptoms related to posttraumatic stress could have been better dealt with using structured diagnostic interviews. We chose the PCL-C as it is a relatively efficient instrument to carry out a diagnosis of probable PTSD although it takes into...
account only the symptom criteria of DSM-IV-TR (i.e., symptom clusters B, C, and D). Nevertheless, our results are similar to those obtained in other studies that have employed this style of questionnaires (Van Driel & Oden Velde, 1995; Rocha et al., 2008). We wish to stress that, in T1, the results of the PLC-C inform only of symptoms related to stress, as less than a month had passed since the appearance of the cause of stress. The sole study that has evaluated patients so soon after the MI was that of Ginzburg et al. (2003) who, 4 days after the MI, evaluated the the presence of probable Acute Stress Disorder by using a questionnaire (Cardena, 1996).

In any case, our investigation shows that one must be cautious with regard to the psychopathological implications of important physical conditions. The sufferance of a severe and unexpected physical condition does not guarantee the appearance of symptoms related to the trauma. Therefore, it is necessary to be very cautious in the use and abuse of the term trauma to characterize common medical problems even when they may be potentially life-threatening.

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References


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