

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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The concept of trauma has significantly changed in the last three decades. Although trauma has historical ties to devastating psychological reactions in the battlefield, it has expanded to cover intense human responses in a diversity of contexts (McNally, 2003). Following its proposal in 1980 in the Diagnostic and Statistical Manual–III (APA, 1980), the label PTSD began to be applied to persons who had suffered a wide range of traumatic experiences (e.g., rape, natural catastrophes, life-threatening illnesses, etc.). Even more recently, in the DSM-IV (APA, 1994), medical illness was explicitly mentioned as a potentially traumatic event. In other words, the possibility that the experience of an

illness (such as cancer or heart disease) could cause PTSD or a related disorder was directly accepted.

Cardiac conditions, such as myocardial infarction (MI), may constitute a good scenario for the analysis of symptoms related to stress. These are events that are normally sudden and life-threatening. Studies on the prevalence of PTSD in groups with cardiovascular problems reveal, nevertheless, a low prevalence of this disorder or of similar ailments. As can be seen in Table 1, the levels vary between 3% (Bennett, Conway, Clatworthy, Brooke, & Owen, 2001) and 24% (Pedersen, Middel, & Larsen, 2003; Pedersen, van Domburg, & Larsen, 2004) in studies with patients who have suffered a

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

Study	Population	Medical diagnosis	Evaluation of PTSD	Assessment time	Probable prevalence,% (N)
Kutz et al. (1994)	100	MI	PTSD inventory	6–18 months	25% (9)
Doerfler et al. (1994)	50	MI or bypass	RI+algorithm based on DSM III-R	6 months	8% (4)
Van Driel et al. (1995)	23	First MI	SCID-R	22–26 months	4% (1)
Bennett et al. (1999)	44	MI	PDS	6–12 months	10.75% (4)
Bennett et al. (2001)	70	First MI	PDS	3 months	3% (3)
Shemesh et al. (2001)	102	Recent MI	IES	6 months	9.8% (10)
Bennett et al. (2002)	89	MI	PDS	3 months	16%
Ginzburg et al. (2003)	116	MI	PTSD Inventory +DSM-IV	T1: 4 days (ASD) T2: 7 months	T1: 18% (21) T2: 16% (18)
Pedersen et al. (2004)	T1:112 T2: 102	First MI	PDS	T1: 4–6 weeks T2: 9 months	T1: 24% (25) T2: 14%
Shemesh et al. (2004)	65	MI	IES	6 months	20% (3)
O'Reilly et al. (2004)	54	MI with or without SCA	SCID, PDS, IES	3–18 months	With SCA: 19% (5); Without SCA: 7% (2)
Chung et al. (2006)	96	MI	PDS	> 1 months	30%
Rocha et al. (2008)	31	MI	SCID	1–2 months	4% (1)
Hari et al. (2010)	274	MI	PDS	T1: 60 days; T2: 32 mo	T1: 19.0% (52); T2: 10.2% (28)

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.

41 first MI. In the case of patients who have suffered several
42 incidents, the levels oscillate between 4% (Rocha et al.,
43 2008) and 30% (Chung, Berger, Jones, & Rudd, 2006).

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

51 Although the impact of myocardial infarct on psycho-
52 pathological problems (e.g., depression, disability, etc.)
53 has received some attention in the last years, much less is
54 known on the presence and the role of positive emotions
55 that can coexist with that condition. This perspective
56 is also important as there is sound evidence that positive
57 psychological states are associated with improved health
58 outcomes and lower morbidity (Lyubomirsky, King, &

Diener, 2005; Pressman & Cohen, 2005). For example,
happy individuals cope better with breast cancer (Peled,
Carmil, Siboni-Samochoa, & 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

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.

Method

Participants

The initial sample comprised 76 participants of which 54 were men (71.1%). The median age of the sample was 60 years (range: 35–87 years). Only patients with a first episode of MI were included. All were in-patients in a Coronary Intensive Care Unit (Getafe Hospital, Madrid) and were evaluated, in the first instance, within the first 48–72 hours after the MI. A number of exclusion criteria were used:

- (1) Having suffered a similar episode on other occasions.
- (2) Being less than 18 years of age.
- (3) Not being fluent in Spanish.
- (4) Having a mental condition (e.g. dementia or psychotic episode) impeding a coherent interview.

After 4–5 months ($Mdn = 4.63$), follow-up was made with 48 of the patients (i.e., 63% of the original sample) and, after 13 months ($Mdn = 13.21$), 33 participants were evaluated (i.e., 43.4% of the original sample). In the analysis of the data from the follow-up, only the final group of 33 participants who completed the three evaluations of the study was included.

The principal causes of attrition were: inability to contact the patient due to change of telephone or domicile (32.5%), lack of desire of patient to continue participation or being too busy (32.5%), death of the patient (18.6%), and difficulty in traveling to the hospital to perform the interview (16.3%). An analysis was made to ensure that the participants who continued in T2 and T3 had no socio-demographic or clinical difference to those who did not continue in the study. No significant difference was found with regard to any of the variables analyzed (age, gender, and clinical and psychological measures).

Procedure

The MI patients were interviewed for the first time in the Coronary Unit 48–72 hours after their admission to the hospital (T1). After acceptance to participate in the study and the signing of consent forms, the evaluation protocol was applied for a period of approximately 60 min.

Five months after the MI (T2) and again after 13 months (T3), the patients were contacted by telephone and called to the hospital where the follow-up protocol was applied for duration of approximately 40 min.

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: [$t(31) = -0.345$; $p = 0.002$]; 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%).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.

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

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

	Time 1		Time 2		Time 3		Score range
	M	Sd	M	Sd	M	Sd	
<i>PTSD symptoms (PCL-C)</i>							
Total score	22.67	5.13	26.50	11.85	23.00	7.46	17–85
Re-experiencing	6.64	2.33	8.06	4.24	6.34	4.34	5–25
Avoidance	8.94	2.41	9.40	4.53	8.75	2.93	7–35
Hyperarousal	7.09	2.75	9.25	5.22	7.91	2.24	5–25
<i>Perception of the event</i>							
Traumatic event	4.33	3.38	8.76	2.21	8.97	2.53	0–10
Life at risk	4.69	3.52	4.09	3.32	3.53	2.86	0–10
Perception of severity	7.03	2.60	7.33	2.84	7.09	2.56	0–10
<i>Psychological measures</i>							
GHQ12 (Total)	11.63	4.94	11.61	6.85	10.50	5.08	0–36
GHQ6 (Positive health)	11.41	1.63	10.84	2.79	11.28	1.65	0–18
GHQ6 (General distress)	4.96	4.29	4.34	4.45	3.78	3.98	0–18
Optimism (LOT-R)	11.22	3.33	11.67	3.09	11.16	3.51	3–15
Optimism about recovery	4.19	1.12	4.24	1.06	4.47	1.04	1–5
Positive affect (PANAS)	29.25	9.24	29.47	8.17	34.75	11.15	10–50
Negative affect (PANAS)	17.00	7.44	19.05	10.14	17.31	8.24	10–50

Notes: PCL, The PTSD Checklist; GHQ, Goldberg Health Questionnaire (12- and six-item versions); LOT-R, Life Orientation Test—Revised; PANAS, Positive and Negative Affective Schedules.

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).

It could be hypothesized that the increased perception of the event as “traumatic” at T2 and T3 compared to T1 reflects a memory bias. Yet, it is more likely that these

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

	Time 1 $n = 76$		Time 2 $n = 48$		Time 3 $n = 33$	
	%	n	%	n	%	n
<i>Probable PTSD</i>	1.4	1	11.1	5	3.1	1
PCL-Total score > 44						
<i>Symptom clusters</i>	18.4	14	25.0	12	18.2	6
Re-experiencing						
Avoidance	1.3	1	4.2	2	0	0
Hyperarousal	7.9	6	20.8	10	18.2	6

differences reveal that at T1 (i.e., only a few days after the event), MI patients may not have enough perspective to judge the medical and psychosocial consequences of the event. Interestingly, contrary to other studies (Ginzburg et al., 2003), the high perception of the event as severe and traumatic did not correspond to a high level of PTSD in our sample. It is possible that this elevated perception of seriousness may be the result of the impact of the heart attack on other areas of functioning (e.g., work performance, physical and sexual activity, perception of disability, and limitations) rather than the direct effects of the MI itself. In any case, the study reveals that the perception of the event can change significantly with the passing of time and it is necessary that clinicians be aware of this factor.

One of the advantages of the design of our study was the ability to be able to make an immediate evaluation of the patient's affective state during the first hours following the heart attack. In general we have found that there are no significant changes either in total symptomatology in the PCL-C or in patterns of symptoms related to the stress (i.e., re-experiencing and avoidance) over time (i.e., 5 months and 13 months later). The only exception was a significant increase of hyperarousal from T1 to T2, returning in T3 to its basal level. As changes in arousal are not a common clinical characteristic of MI (Thygesen, Alpert, & White, 2007), it is likely that the increases in hyperarousal detected in our sample are instead part of a psychological reaction in response to this serious medical condition.

There were neither significant changes with regard to positive emotions nor optimism present from the onset. These positive emotions were significantly greater than the negative ones at all times of measurement, so it is not probable that the affective well-being that was observed from the first days after the event results from an effect of illusory optimism that has been described elsewhere (Zoellner & Maercker, 2006). It is possible that these positive emotions not only have an important role as buffer factors for negative emotions (Fredrickson, 2001), but that they are also important for a better recuperation from the medical problem (Howell, Kern, & Lyubomirsky, 2007; Vázquez, Hervás, Rahona, & Gomez, 2009). In the case of trauma-related disorders, recent investigations have made clear that positive emotions and cognitions are not necessarily absent (Fredrickson, Tugade, Waugh, & Larkin, 2003; Vázquez & Hervás, 2010). Although there are few references to positive emotions in patients having suffered an MI (Affleck, Tennen, & Croog, 1987; Brummett, Morey, Boyle, & Mark, 2009), the finding that these patients are capable of optimism and of feeling relatively intense positive emotions is important. In fact, there is growing evidence showing that resilience is mediated by a complex network of mediational cognitive and motivational processes (Lyubomirsky, 2001) in which

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 post-traumatic 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 post-traumatic 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 & Op den 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 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 suffering 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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