Clinical Diagnosis of Posttraumatic Stress Disorder After Myocardial Infarction

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ABSTRACT

Background: Clinician-rated large-scale studies estimating the prevalence of posttraumatic stress disorder (PTSD) related to myocardial infarction (MI) and identifying predictors of clinical PTSD are currently lacking.

Hypotheses: We hypothesized that PTSD is prevalent in post-MI patients and that the subjective experience of the MI determines PTSD status.

Methods: We approached 951 post-MI patients with a questionnaire screening for PTSD symptoms related to their MI. Those responding and meeting a cutoff of PTSD symptom levels were invited to participate in a structured clinical interview to diagnose PTSD following Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria. Fear of dying, feelings of helplessness, and severity of pain perceived during the MI were also assessed by visual analog scales.

Results: The screening questionnaire was completed by 394 patients, whereby 77 met the cutoff for the interview (8 patients declined the interview). Forty of 394 patients (10.2%) had clinical PTSD (subsyndromal and syndromal forms combined). Younger age (OR 0.95, 95% CI 0.91–0.99), greater fear of dying (OR 2.77, 95% CI 1.28–5.97), and more intense feelings of helplessness (OR 2.97, 95% CI 1.42–6.21) were independent predictors of PTSD status. Perceived pain intensity during MI, sex, type of index MI, left ventricular ejection fraction, number of coronary occlusions, and highest level of total creatinine kinase were not significant predictors.

Conclusions: Clinical PTSD is prevalent in post-MI patients. Demographic and particularly psychological variables related to the subjective experience of the event were stronger predictors of PTSD status than were objective measures of MI severity.

Key words: cardiovascular disease, myocardial infarction, posttraumatic stress disorder

Introduction

Clinicians are aware that patients may experience a myocardial infarction (MI) as a traumatic event[1] that commonly provokes intense emotions and challenges normal daily functioning.[2,3] Approximately 15% of patients develop posttraumatic stress disorder (PTSD) in the aftermath related to their MI.[1,4] Although a psychiatric disorder, PTSD is increasingly acknowledged as an important clinical entity in cardiovascular medicine.[5] The PTSD is associated with poor compliance with cardiac therapy[6] and poor cardiovascular outcomes.[7] To meet the definition of PTSD,[8] patients must have experienced the MI as an event involving threatened death to which they responded with intense fear or helplessness. Patients must also have reexperienced the MI (e.g., in thoughts or dreams, avoided stimuli associated with the MI, and had symptoms of heightened arousal for at least 1 mo).

Previous investigations largely applied self-rated symptom questionnaires, which tend to overestimate the prevalence of PTSD in post-MI populations.[1] Clinical interviews yielded prevalence rates between 0% and 8%, although in comparably small samples.[9–11] Using a structured clinical interview, we recently diagnosed 9.4% of 190 patients with DSM-IV PTSD related to their MI.[12] Because of its limited sample size, that study did not allow us to reliably probe for predictors of a clinical PTSD diagnosis.

Therefore, we continued enrollment of post-MI patients in our previously described protocol,[12] thereby roughly doubling the sample size. We predicted a prevalence of clinical PTSD of about 10%. We hypothesized that the subjective experience of the MI determines PTSD status at least as strongly as do demographic variables and objective measures of MI severity.

Methods

Study Design and Participants

The Ethics Committee of the State of Bern, Switzerland, approved the study protocol in accordance with the Declaration of Helsinki. All patients provided informed consent. We approached 951 patients by mail who had previously been referred to the Cardiology Department of the Bern University Hospital, Switzerland, with a verified ST-segment elevation myocardial infarction (STEMI) or non-ST-segment elevation myocardial infarction (NSTEMI) as per previously published guidelines.[12,13] All included patients had undergone percutaneous transluminal coronary angioplasty at

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admission. Patients were excluded if they did not speak German or lived too far away from the University Hospital (>90 min by car or train).

Psychometric Assessment

Screening for PTSD symptom levels: We mailed the self-rated Posttraumatic Diagnostic Scale (PDS)[14] to all 951 patients with a verified MI. We applied the validated German version of the PDS showing excellent internal consistency (Cronbach's $\alpha = .91$; Steil, in press).[15] The PDS comprises 17 questions mapping onto DSM-IV symptoms for PTSD, yielding a maximum score of 51 points. Patients who met the cutoff of ≥15 points[16] were invited for the structured interview.

Subjective experience of infarction: Patients retrospectively rated 3 aspects of MI perception on Likert scales: (a) *fear of dying:* "During my referral to the hospital, the emergency unit, or the intensive care unit, I was afraid I was dying" (0 = absolutely not true, 10 = absolutely true); (b) *helplessness:* "When the doctor told me I had a heart attack, I was frightened, felt helpless, and was afraid of losing control of the situation" (0 = absolutely not true, 10 = absolutely true); and (c) *pain intensity*: "Please indicate how strong your pain was during the heart attack" (0 = no pain at all, 10 = intolerable pain).

Diagnosis of clinical PTSD: We used the Clinician-Administered PTSD Scale (CAPS) for the structured interview as developed by the National Center for PTSD to diagnose DSM-IV PTSD.[17] The German version shows good internal consistency for the severity score of all 17 symptom items (Cronbach's $\alpha = .88–.92$) and for each of the 3 (i.e., B, C, D; see below) PTSD symptom clusters ($\alpha = .73–.88$).[18] The frequency and intensity of each symptom are rated between 0 (never) and 4 (almost always). A symptom is given when frequency is at least 1 point and intensity is at least 2 points. One of 5 symptoms is required for criterion B (reexperiencing cluster), 3 of 7 symptoms for criterion C (avoidance cluster), and 2 of 5 symptoms for criterion D (hyperarousal cluster). The PTSD severity is obtained by adding up symptom scores of criteria B + C + D. Patients were diagnosed with syndromal PTSD if meeting criteria B + C + D and with subsyndromal PTSD if meeting criterion B plus either C or D.[19]

Demographic and Medical Data

Age, sex, date of index MI, type of index MI (first-time versus recurrent MI), left ventricular ejection fraction (LVEF) as measured by ventriculography during coronary angiography, number of coronary occlusions, and highest level of total serum creatinine kinase (CK) were obtained from medical charts. We used the number of coronary occlusions, LVEF, and total CK as proxy measures of objective MI severity. Total CK levels and their time courses during the acute phase of the MI were measured by different laboratories and did not follow a standardized protocol; therefore, "highest" CK levels did not necessarily reflect "peak" levels 24 h after MI onset. Accordingly, the highest CK levels could be close to normal in subjects who only had CK measured in the first couple of hours post-MI.

Statistical Analyses

We used the SPSS 13.0 statistical software package (SPSS Inc., Chicago, IL, USA), setting significance level at $p<0.05$ (2-tailed). Data for PDS and Likert scores, number of days after MI that the PDS was sent out, LVEF, and CK level were not normally distributed (Kolmogorov–Smirnov test) and transformed by the Blom procedure before analyses. For clarity, we present all data in original units (means±SDs, ranges). For calculations of differences between groups, the Student' *t* test, the Pearson chi-square test, and Fisher's exact test were used. We applied logistic linear regression analysis (Wald test) to identify OR (95% CI) of predictors of clinical PTSD diagnosis and Nagelkerke R^2 statistics to estimate effect sizes.

Results

Patient Characteristics

Of the 951 patients approached, 426 returned the PDS questionnaire (accrual rate 45%). Of these, 16 declined to participate, and another 16 had died, whereby their relatives had sent back the questionnaire, leaving 394 patients whose characteristics are presented in Table 1. Data were missing for CK levels in 54 patients, for LVEF in 13 patients, for fear of dying in 9 patients, and for feelings of helplessness and perceived pain in 6 patients each. The type of the index event was unclear in 7 patients and coded as first-time MI. Eight and 4 patients missed 1 and 2 items of the PDS questionnaire, respectively; these were replaced with the mean of completed items. The 394 patients who responded to the survey did not differ in age from the 525 patients who did not respond ($p = 0.86$). The proportion of nonresponders was higher in women (67%) than in men (55%), $p = 0.002$.

Clinical Diagnosis of PTSD

Seventy-seven patients (19.5%) met the PDS cutoff score for the diagnostic interview. Eight patients declined the interview (5 men, 3 women; PDS score 21±7, range 15–34). Of the 69 patients interviewed, 14 had syndromal PTSD (20%), 26 had subsyndromal PTSD (38%), and 29 (42%) did not fulfill the criteria for clinical PTSD. With regard to the entire sample of screened patients (n = 394), the prevalence of a clinical diagnosis of PTSD (either syndromal or subsyndromal) was 10.2%. Table 2 demonstrates that relative to patients without PTSD, those with PTSD were younger and, as expected, scored higher in posttraumatic stress levels (questionnaire and interview), in fear of dying, and in helplessness.

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TABLE 1: Characteristics of patients screened for PTSD ($n = 394$)

Men/women (%)	326 (83%)/68 (17%)
Age (y)	61±10 (38–85)
First-time/recurrent MI (%)	362 (92%)/32 (8%)
Number of coronary occlusions: 1, 2, 3	174 (44%), 120 (31%), 100 (25%)
LVEF (%)	50±11 (20–75)
Highest serum total CK level obtained (U/L)	1,243±1,279 (8–6,339)
Sending out of PDS questionnaire after MI (d)	98±157 (12–1,673)
PDS score	8.8±8.9 (0–48)
Fear of dying score	2.7±3.1 (0–10)
Feelings of helplessness score	2.9±3.2 (0–10)
Perceived pain score	6.0±2.9 (0–10)

Data are given as means±SDs (ranges). CK, creatinine kinase; LVEF, left ventricular ejection fraction; MI, myocardial infarction; PDS, posttraumatic diagnostic scale.

Predictors of Clinical PTSD

To identify independent demographic, medical, and psychological predictors of clinical PTSD (subsyndromal and syndromal forms combined), we performed a logistic regression analysis of the entire sample of 394 patients. The 8 patients who declined to undergo the CAPS interview were grouped along with the 346 patients who did not have PTSD as per a PDS score <15 points ($n = 317$) or following the CAPS interview ($n = 29$).

Table 3 shows the results of the regression model we built by subsequently entering 3 blocks of independent variables. Younger age ($B = -0.05 \pm 0.02$, $p = 0.023$), greater fear of dying ($B = 1.02 \pm 0.39$, $p = 0.009$), and more intense feelings of helplessness ($B = 1.09 \pm 0.38$, $p = 0.004$) emerged as independent predictors of PTSD status, whereas sex, type of index event, LVEF, number of coronary occlusions, time since the PDS questionnaire was sent out, and perceived pain did not.

We computed 2 complementary analyses. The first one omitted the 8 subjects who declined to be interviewed; younger age ($p = 0.022$), greater fear of dying ($p = 0.013$), and more helplessness ($p = 0.003$) were all maintained as significant predictors of PTSD status. The second analysis also considered CK level and was performed on 34 patients with PTSD and 306 without. Again, younger age ($p = 0.017$), greater fear of dying ($p = 0.036$), and more helplessness ($p = 0.011$) were maintained as significant predictors of PTSD status; LVEF ($p = 0.50$), number of coronary occlusions ($p = 0.28$), and CK level ($p = 0.68$) were not significant predictors.

Discussion

Although we recently diagnosed 9.4% of patients with DSM-IV PTSD in the first 190 post-MI patients screened and enrolled in the current protocol,[12] this prevalence was largely maintained when doubling the sample. This finding speaks for the robustness of the observation that about 10% of patients develop PTSD in the aftermath of an acute MI. Together with the prevalence rates of 7%[10] and 8%[11] found in smaller studies also applying an interview, our data suggest that clinical PTSD is not a negligible disorder in post-MI patients. To compare, the 12-mo prevalence of subsyndromal PTSD was less than 2%, and no individual met criteria for syndromal PTSD in a representative Swiss population sample.[20] These interview data also support our previous notion that self-rated PTSD symptom questionnaires may yield too high prevalence rates (i.e., approximately 15%).[1]

In the patients who underwent a clinical interview, those with clinical PTSD were younger and had also felt a relatively greater fear of dying and helplessness during the MI relative to those without PTSD. Interestingly, the trend toward a relatively longer period since the MI in patients with PTSD might suggest that once established, clinical PTSD may not readily wane over time.

In the entire sample, younger age and greater levels of fear of dying and helplessness perceived during the MI emerged as independent predictors of clinical PTSD, whereas sex, type of MI, LVEF, number of coronary occlusions, and highest CK levels did not. These findings are in line with previous studies showing that younger age, and perceived threat, but not sex, CK level, index event, and other objective measures of MI severity, were associated with PTSD symptom levels.[21–23] We did not find that perceived pain predicted PTSD status, contrasting with previous studies in which pain scores did predict self-rated PTSD symptom levels.[12,22] We interpret that our study provides little evidence for the assumption that certain demographic, medical, and psychological factors differentiate clinical PTSD status from elevated PTSD symptom levels. This might be expected because posttraumatic stress occurs on a continuum of severity.[23]

The application of a structured clinical interview and the ample sample allowing us to identify predictors of clinical PTSD status were strengths of our study, which, however, also had its limitations. More than half the patients approached, particularly women, did not respond to the survey. Therefore, our findings are not necessarily transferable to a general post-MI population. Nevertheless, the accrual rate was comparable with similar studies.[21–23] It could be that posttraumatic stress levels were comparably higher in patients who declined to participate to avoid being

TABLE 2: Characteristics of interviewed patients with and without PTSD ($n = 69$)

Variable	Patients with PTSD ($n = 40$)	Patients without PTSD ($n = 29$)	p Value
Men/women (%)	31 (78%)/9 (22%)	21 (72%)/8 (28%)	0.628
Age (y)	54±8 (39–72)	60±10 (43–79)	0.008
First-time/recurrent MI (%)	38 (95%)/2 (5%)	24 (83%)/5 (17%)	0.122
Number of coronary occlusions: 1, 2, 3	23 (57%), 11 (28%), 6 (15%)	14 (48%), 8 (28%), 7 (24%)	0.603
LVEF (%)	52±10 (25–65)	54±9 (25–65)	0.191
Highest total CK (U/L)	1,437±1,499 (78–6339)	907±1011 (78–3,735)	0.541
CAPS score	52±21 (20–119)	25±10 (9–47)	<0.001
Days since index event	136±106 (45–475)	96±52 (24–224)	0.069
PDS scale score	27±9 (15–48)	19±4 (15–33)	<0.001
Fear of dying score	6.7±3.0 (0–10)	4.5±2.9 (0–10)	0.010
Feelings of helplessness score	7.2±2.9 (3–10)	4.8±3.0 (1–10)	0.004
Perceived pain score	7.4±2.6 (0–10)	7.3±2.6 (0–10)	0.741

Data are given as means±SDs (ranges). CAPS, clinician-administered PTSD scale; CK, creatinine kinase; LVEF, left ventricular ejection fraction; MI, myocardial infarction; PDS, posttraumatic diagnostic scale. Data were missing for LVEF in 1 patient, for CK in 6 patients, for fear of dying score in 2 patients, and for perceived pain score in 1 patient.

TABLE 3: Logistic regression analysis for clinical PTSD status

Steps of the model	Blocks of entered variables	OR (95% CI)
Step 1: forced entry [a] ($n = 394$, 40 with PTSD)	Sex	0.60 (0.26–1.38)
	Age	0.93 (0.90–0.96)
Step 2: forced entry [b] ($n = 381$, 40 with PTSD)	Sex	0.67 (0.29–1.54)
	Age	0.93 (0.90–0.96)
	Index event	1.31 (0.29–6.02)
	LVEF	1.20 (0.82–1.76)
	Number of coronary occlusions	0.76 (0.48–1.21)
Step 3: forced entry [c] ($n = 375$, 38 with PTSD)	Sex	0.53 (0.20–1.43)
	Age	0.95 (0.91–0.99)
	Index event	2.50 (0.41–15.06)
	LVEF	1.18 (0.76–1.85)
	Number of coronary occlusions	0.69 (0.41–1.17)
	Days after MI that PDS was sent out	1.29 (0.86–1.94)
	Fear of dying	2.77 (1.28–5.97)
	Helplessness	2.97 (1.42–6.21)
	Pain	0.77 (0.45–1.32)

LVEF, left ventricular ejection fraction; MI, myocardial infarction; PDS, posttraumatic diagnostic scale; PTSD, posttraumatic stress disorder. [a]Model accounted for 10.3% of the variance (chi square = 20.0, $df = 2$, $p<0.001$). [b]Model accounted for 12.0% of the variance (chi square = 23.0, $df = 5$, $p<0.001$). [c]Model accounted for 41.7% of the variance (chi square = 84.1, $df = 9$, $p< 0.001$).

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reminded of the MI in an interview.[21] If so, the "true" prevalence of clinical PTSD might be even higher in a general post-MI population. The CK measurements were not standardized, and the retrospective assessment of MI perception could have inflated a recall bias. In particular, there was considerable heterogeneity in the time between the MI and assessment of its subjective perception, ranging between 2 wk and almost 5 y. The subjective perception of the MI at admission will decrease as time goes by. Finally, we did not assess other potentially important predictors of PTSD status such as previous psychiatric disorders and social support.[4]

Altogether, we found that PTSD is a clinical disorder with a considerable, high prevalence in the post-MI populations. Psychological variables related to the subjective experience of MI predicted PTSD status better than did objective measures of MI severity.

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