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The Influence of Personality Traits on Specific Coping Styles and the Development of Posttraumatic Stress Symptoms following Acute Coronary Syndrome: A Cluster Analytic Approach

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Abstract: Objective: A growing body of literature suggests a relationship between personality traits and posttraumatic stress disorder (PTSD) symptoms after acute coronary events (ACS). However, specific personality profiles have not been examined in patients after ACS. Thus, the aim of the present study was to examine personality profiles created from response patterns on the resilience, alexithymia and type D personality (TDP) scales and to examine associations with PTSD symptoms, symptom clusters and coping styles among a sample of ACS patients. Methods: A cluster analytic approach was utilized to identify risk profiles based on personality variables and a series of ANOVAs in 154 patients. Post hoc analyses were conducted to examine the relationship between each profile, and interviewer-rated PTSD symptoms and different coping styles. Results: The analyses indicated a three-cluster solution, including low- (high resilience, low alexithymia and non-TDP), medium- (average resilience, average alexithymia and non-TDP) and high-risk (low resilience, high alexithymia and TDP) profiles. Clusters differed significantly in all three coping subscales. At 3-month follow up, clusters differed significantly in all three PTSD subscales (re-experiencing, avoidance and hyperarousal). At 12-month follow up, the differences remained significant for the hyperarousal subscale only. Conclusions: The personality profiles identified and the respective associations to PTSD symptoms and coping strategies highlight the potential impact for the psychological adjustment following ACS.

Keywords: personality traits; myocardial infarction; acute coronary syndrome; alexithymia; resilience; coping; posttraumatic stress symptoms

1. Introduction

Following an acute coronary syndrome (ACS), 4% of patients fulfil the diagnostic criteria of posttraumatic stress disorder (PTSD) and 12% of all ACS patients develop clinically relevant PTSD symptoms [1,2]. ACS-induced PTSD symptoms comprise symptoms of re-experiencing aspects of the ACS (e.g., nightmares and flashbacks), avoidance of ACS-related stimuli (e.g., activities and situations), changes in thoughts and mood (e.g., shame and blame) and hyperarousal (e.g., hypervigilance and sleeping problems); these symptoms

have been associated with recurrent cardiac events, increased mortality and decreased quality of life [1–4]. An intriguing line of research suggests that subjective perception of severity predicts PTSD symptoms rather than ACS severity measured by cardiac enzyme levels and left ventricular ejection fraction [5]. Particularly in highly distressed situations, individual predisposition or vulnerability favor the development of PTSD symptoms rather than the severity of ACS itself. Therefore, recent lines of research have focused on individual personality traits to explain the development of ACS-induced PTSD symptoms [6,7]. Specifically, type D (distressed) personality (TDP) has been shown to be an established risk factor for the development of ACS-induced PTSS. TDP, characterized by a negative, anxious, worried and irritated personality, is described as a combination of pronounced negative affectivity and social inhibition [8]. The proportion of TDP among ACS patients is significantly higher (55%) compared to a healthy control group (33%) [9]. Previous studies have shown that TDP in ACS patients predicted mortality and recurrent cardiac events [10]; however, the magnitude of the effect is small.

Alexithymia is another personality characteristic linked to PTSD symptoms [11]. Alexithymia is described as an inability in emotional processing and defines patients who have (a) difficulties in identifying feelings and in differentiating feelings and bodily sensations, (b) problems expressing their feelings to others, (c) difficulties in visualizing and a lack of fantasy, and (d) a cognitive style that is oriented towards external aspects [12]. Up to 30% of post-ACS patients show alexithymia, a rate twice as high as that in patients without ACS [13]. Both cross-sectional and longitudinal studies found a consistent relationship between alexithymia and ACS-induced PTSD symptoms [13,14].

Resilience on the other hand, has the ability to mitigate the development of ACS-induced PTSD symptoms [15]. It describes a process that involves the competence to cope with ongoing or repeated demands and supports a healthy state in different life domains [16]. Studies have reported that individuals with the ability to adapt to adverse events, including ACS, have lower rates of PTSD symptoms [17]. Resilience is also correlated with coping strategies. When confronted with an ACS, patients actively appraise the event and perceive it as either harmful or not (primary appraisal). Second, they decide subsequently how to deal with it (secondary appraisal) [18]. Whereas task-oriented coping individuals focus on solving the problem or attempt to deal with the situation, individuals with an emotion-oriented coping style show emotional responses to an event and tend to be preoccupied with the situation. Individuals with a more avoidance-oriented coping style avoid thoughts, feelings or stimuli that refer to the situation. Task-oriented coping style is associated with less PTSD symptoms [19]. On the other hand, an avoidance or emotion-oriented-coping style enhances the risk for the development of PTSD symptoms [20].

Previous research has predominantly focused on independent predictive variables, ignoring personality clusters of psychological traits. In addition, personality traits often occur with other personality traits who cluster together [6]. Therefore, it is still largely unknown which and to what extent personality traits that increase the risk of developing ACS-induced PTSD symptoms cluster together.

Considering the above-mentioned findings and assuming that personality traits may be relevant for understanding and supporting patients with ACS-induced PTSD symptoms, the principal aim of this study was to analyze alterations in coping and PTSD symptoms among patients depending on profiles based on personality traits. Differences in PTSD symptoms and coping styles may depend different personality profiles: TDP, alexithymia and resilience. Our hypotheses was that potentially adaptive and maladaptive profiles in the assessed personality traits can be identified and that specific coping styles and PTSD symptoms will be associated with such profiles. Additionally, secondary analyses were run to explore differences in each PTSD symptom subscale (re-experiencing, avoidance/numbing and hyperarousal) based on different personality profiles.

2. Materials and Methods

2.1. Participants

We investigated a subsample of patients who participated in the Myocardial Infarction–Stress Prevention Intervention (MI-SPRINT) randomized controlled trial (RCT), a study that examined if early psychological counselling can prevent ACS-induced PTSD symptoms [21]. Each group intervention consisted of one face-to face 45 min session delivered at the bedside within 48 h after hospital admission. Both interventions, which were trauma-focused counseling and stress counseling as an active control, used first aid strategies, although the content of the psychoeducation differed. In the trauma-focused intervention group, patients were educated about the possibility that PTSD symptoms could occur after ACS and how these might be handled. Information, activation of resources and cognitive r(e)structuring were discussed. In the stress counseling control group, patients were educated about stress in general, how stress can be dangerous to the heart and how stress might be handled. At the end of the session, both groups received an information booklet with detailed information about trauma stress or stress in general. The hypothesis behind the education about PTSD symptoms was that patients would cope better with ACS-induced PTSD symptoms and would show lower PTSD prevalence compared to the active control group.

Patients who were 18 years or older; had a verified acute ST-elevation myocardial infarction (STEMI) or non-STEMI; and were referred for acute coronary intervention to the Cardiology Department, Bern University Hospital, Berne, Switzerland, were enrolled in the study between January 2013 and December 2015. Myocardial ischemia symptoms and prolonged electrocardiographic ST-segment elevation are hallmarks of STEMI, which also causes the production of biomarkers (such as troponin) indicative of myocardial necrosis.

Procedure

The recruitment details have been described elsewhere [21]. The original sample of the MI-SPRINT trial consisted of 190 MI patients, all Caucasian; 154 completed the 3-month follow-up, and 104 completed the 12-month follow-up. Participants needed to be at least 18 years old, to have stable circulatory conditions (i.e., no signs of cardiogenic shock, such as paleness, restlessness, cold sweats, and heart rates greater than 100/min and systolic blood pressure less than 100 mmHG), and to experience a high level of acute distress during MI. For "pain intensity (during MI)" of at least 5 as well as "fear of dying (till admission to the coronary care unit)" and/or "worrying and feeling helpless (after being notified about having MI)," acute distress during MI was based on numeric rating scales (range 0–10). If a participant had emergency coronary artery bypass grafting, had a concomitant illness likely to result in death within a year, was not properly oriented, or had cognitive impairment, they were excluded from the study. Additional exclusion criteria were current severe clinical depression in the patient's history, suicidal ideations in the previous 2 weeks, inadequate knowledge of German, or current participation in another RCT. We predicted that depressed patients would have trouble focusing during a 45 min counseling session and understanding its content. Patients who were deemed to have significant depression clinically were therefore excluded. The study was carried out in conformity with the Good Clinical Practice Guidelines and the Declaration of Helsinki, and it was registered with ClinicalTrials.gov (NCT01781247). The study was approved by the State of Bern's ethical council (KEK No. 170/12) and was independently overseen by the Clinical Trials Unit at the University of Bern. All study participants provided written informed permission prior to enrollment. None of the test subjects received money in exchange.

2.2. Measures

Participants completed validated questionnaires within 48 h of MI (baseline measures) as well as three months and 12 months after MI (3-month and 12-month follow-up measures). Baseline measures included sociodemographic factors. Assessment of TDP,

alexithymia, resilience and coping and were included in the 3-month follow-up analyses to limit patient burden at hospital admission.

2.3. 3-Month Follow-Up Measures

Personality Traits

Type-D (DS-14)

The German version of the DS 14 scale was used to assess TDP. This scale comprises 14 items, with each item being scored between 0 = false and 4 = true, and consists of two subscales (Negative Affectivity and Social Inhibition) representing two distinct dimensions of TDP. A score $\geq$10 on each subscale is required to meet criteria for TDP [22–24]. The DS-14 showed good internal consistency in our sample (Cronbach's alpha = 0.90).

Alexithymia (TAS-20)

Deficiency in understanding, processing and describing emotions was measured with the German version of the 20-item Toronto Alexithymia scale (TAS-20) [25]. The TAS-20 is a self-report measure assessing three components of the alexithymia construct: (1) difficulty identifying feelings (DIF) ("I often do not know why I am angry"); (2) difficulty describing feelings (DDF) ("Individuals tell me to describe my feelings more"); and (3) externally oriented thinking (EOT) ("It is difficult for me to reveal my innermost feelings, even to close friends"). Items are rated on a 5-point Likert scale between 1 (strongly disagree) and 5 (strongly agree); 5 items are negatively keyed [4,5,10,18,19]. The total score is the sum of the responses of the three alexithymia subscales. The TAS-20 uses cut-off scoring equal to or greater than 51 for "non-alexithymia" and equal to or greater than 61 for "alexithymia". The German version of the TAS-20 showed good convergent and clinical validity [26]. The TAS-20 demonstrated good internal consistency in our sample (Cronbach's alpha = 0.84).

2.4. Resilience

To measure resilience, the short-form of the validated German version [27] of the Resilience Scale by Wagnild and Young (1993) was used [28]. The resilience scale (RS-11) is a one-dimensional scale that records resilience as a competence. The RS-11 comprises 11 items, which measure the construct of resilience one-dimensionally on a seven-point Likert scale (1 = "I do not agree"; 7 = "I completely agree"). A high total value of the RS-11 is to be interpreted as a high level of resilience. The Resilience Scale showed good internal consistency in our sample (Cronbach's alpha = 0.92).

2.5. Dependent Variables

The Clinician-Administered PTSD scale (CAPS), which has been validated for use in Germany, was used to measure the severity of MI-induced PTSD symptoms [29]. Senior clinical psychotherapists educated and oversaw the CAPS interview's conduct by psychology doctoral and medical master's students. Before conducting the CAPS interview on their own, the interviewers had a 2-day training session. The frequency and severity of each of the 17 PTSD symptoms listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) over the preceding months were evaluated. Ratings ranged from 0 (never) to 4 (nearly always) to produce a total severity score of PTSD symptoms related to the MI event ranging from 0 to 136. When frequency was at least 1 point and intensity was at least 2 points, a symptom was identified. The re-experiencing cluster required one of five symptoms, the avoidance cluster required three of seven symptoms, and the hyperarousal cluster required two of five symptoms. When all 3 symptom clusters were fulfilled, patients were diagnosed with full PTSD. The German version of the CAPS showed good internal consistency for the severity score of all 17 symptom items in our sample (Cronbach's α = 0.79 at 3-month follow-up and 0.72 at 12-month follow-up). At 3 months after MI, the German adaption and shortened version of the Coping Inventory for Stressful Situations (CISS) [30] was used. Twenty-four items are rated on a 5-point Likert Scale from "not at all" [1] to "very much" [5]. The questionnaire assesses three different coping styles. Task-oriented

coping, emotion-focused coping, and avoidance-oriented coping. Avoidance-oriented coping can further be distinguished into two subscales: distraction-oriented coping and social-distraction-oriented coping. The Cronbach's Alpha of 0.87 indicated a very good overall reliability of the scale.

2.6. Intervention

The treatment included either stress counseling or trauma-focused counseling (intervention group) (active control group). Within 48 h after admission, study therapists provided counseling in a single, 45 min session. The intervention in both groups involved a counseling session that spent the first five minutes discussing the patient's most pressing concerns. The trauma-focused intervention employed a knowledge-based and resource-oriented strategy focusing on individual resources and coping mechanisms, teaching cognitive restructuring to particularly common MI-triggered traumatic reactions, as well as explicating the idea of psychological trauma and PTSD symptoms that may possibly emerge after MI. Patients in the active control intervention group learned about stress management, behavioral health techniques to enhance daily functioning after MI and the significance of psychosocial stress in coronary heart disease. Following the counseling session, each patient was given a pamphlet with information on managing stress in general or managing posttraumatic stress symptoms associated with having had a MI.

2.7. Data Analysis

Following a cross-sectional design and with the aim of identifying homogeneous grouping in the sample considering participants' scores on the variables measured, a Euclidean distance matrix was calculated, and a hierarchical clustering analysis was performed using Ward's method. Prior to cluster determination, missing data were imputed using the Expectation Maximization method, and all variables were standardized using z scores in order to make them comparable and to avoid undesirable scale effects.

The exploratory analysis revealed a reasonable structure consisting of 3 clusters. This 3-cluster structure was subsequently selected, based on the information contained in the dendogram, which depicts the existence of possible natural clusters (see Supplementary Material Figure S1). Next, one-way ANOVAs were calculated to identify mean differences among clusters in the variables measured. The IBM SPSS program, version 22.0, was used for all the analyses described above. The level of significance was set at $p < 0.05$. Descriptive data are given as means, standard deviation, ranges and frequencies. Finally, effect size measures for one-way ANOVAs were calculated using the G*Power program. Additional chi-square analysis with dichotomic PTSD symptoms variables (as set with a cut-off score of 10 in the CAPS) can be found in the Supplementary Materials.

3. Results

Demographic characteristics of the sample are shown in Table 1. Most of the participants were male with a mean age of 59 years.

Bivariate correlations between variables for the whole sample are shown in the Supplementary Materials Table S1). Emotion-oriented coping was statistically and positively associated with TDP (r = 0.53; $p < 0.01$) alexithymia (r = 0.53; $p < 0.01$) and negatively associated with resilience (r = −0.37; $p < 0.01$). Task-oriented coping was statistically and negatively associated with TDP (r = −0.20; $p < 0.05$) and alexithymia (r = −0.29; $p < 0.01$) and positively associated with resilience (r = 0.53; $p < 0.01$). Avoidant coping was only statistically associated with resilience (r = 0.29; $p < 0.01$). Regarding PTSD symptoms at 3-month follow-up, it was positively associated with TDP (r = 0.36; $p < 0.01$) and alexithymia (r = 0.30; $p < 0.01$) and negatively associated with resilience (r = −0.41; $p < 0.01$). At 12-month follow-up, only the correlation between PTSD symptoms and resilience (r = −0.30; $p < 0.01$) remained statistically significant.

Table 1. Characteristics of the sample at 3-month follow-up (n = 154) and at 12-month follow-up (n = 104).

	Mean (SD) or Percentages (N)	Observed Range
Gender, male %	84.4 (130)	
Age	58.96 (9.99)	33–84
Type D personality, %	16.2 (25)	
Alexithymia	41.26 (10.45)	21–68
Resilience	61.23 (11.11)	20–77
Emotion-oriented coping	19.33 (5.86)	8–35
Task-oriented coping	29.86 (5.62)	8–40
Avoidant coping	22.36 (6.96)	8–40
Post-traumatic Stress Symptoms at 3-month follow-up	10.64 (10.52)	0–54
Reexperiencing symptoms at 3-month follow-up	2.73 (4.12)	0–21
Avoidance symptoms at 3-month follow-up	2.94 (4.34)	0–25
Hyperarousal symptoms at 3-month follow-up	4.94 (4.38)	0–19
Post-traumatic Stress Symptoms at 12-month follow-up	9.50 (8.74)	0–52
Reexperiencing symptoms at 12-month follow-up	2.07 (3.14)	0–18
Avoidance symptoms at 12-month follow-up	2.96 (4.11)	0–18
Hyperarousal symptoms at 12-month follow-up	4.38 (3.78)	0–16

3.1. Cluster Analysis

Cluster analysis suggested the existence of three clusters, as shown in the Supplementary Materials Figure S1). Means and standard deviations of the assessed variables for each obtained group are shown in Table 2, which also includes information regarding the comparison (ANOVA) between the clusters in those variables (F value and post hoc comparisons).

Table 2. Means, standard deviations and differences between means in the assessed variables for each cluster group.

Personality Cluster	N	Type D Personality	Alexithymia Mean (SD)	Resilience Mean (SD)
1	61	no	33.50 (6.39)	70.00 (4.41)
2	60	no	43.96 (7.44)	56.73 (9.92)
3	25	yes	53.73 (9.43)	49.61 (9.91)
Total	146	-	41.26 (10.45)	61.05 (11.33)
Mean differences (F values)		-	72.88 ($p < 0.001$)	71.05 ($p < 0.001$)
Effect size		-	0.71	0.70
Post hoc analysis			3 > all All > 3	1 > all All > 3

A graphic of the standardized mean scores of the identified clusters is presented in Figure 1.

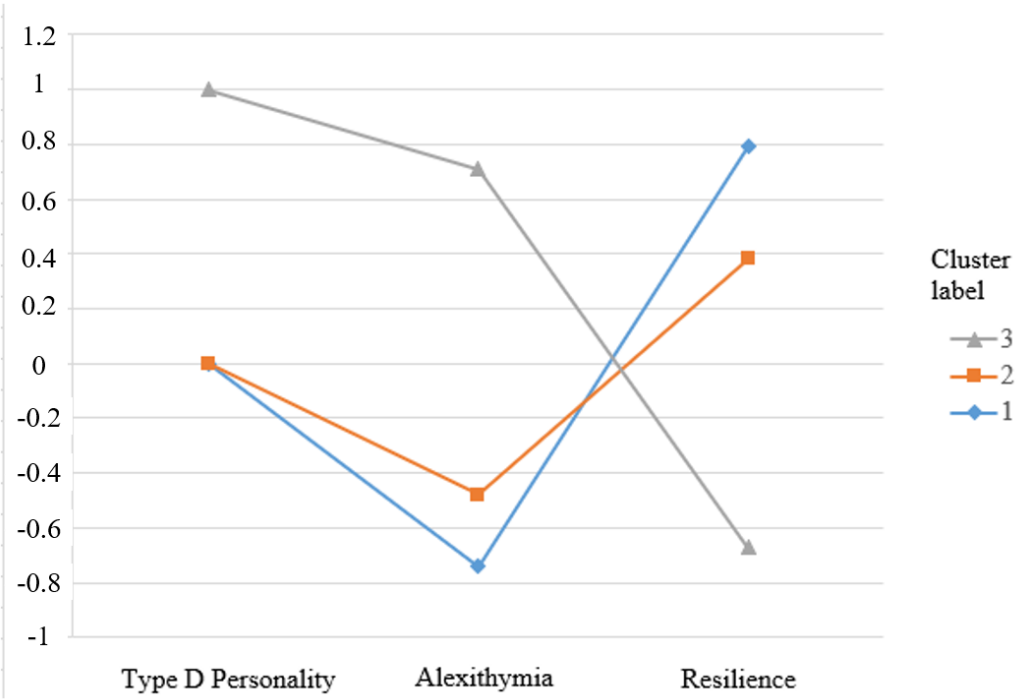

Figure 1. Standardized mean scores of the obtained clusters in the variables of interest. Note: Type D personality is presented as 0: "non type D personality"; 1: "type D personality".

As shown in Figure 1, there was one cluster (cluster 3) that may represent a particularly pathological cluster compared with two other more adaptive clusters (clusters 1 and 2).

Cluster 1 (N = 61) was labelled Low-Risk since it included patients who scored the highest in resilience and the lowest in alexithymia and showed non-TDP. Cluster 2 (N = 60) was labelled Medium-Risk, since it included patients who scored around the average in resilience and alexithymia and showed non-TDP. Cluster 3 (N = 25) was labelled High-Risk since it included patients who scored the lowest in resilience and highest in alexithymia and showed TDP.

3.2. Cluster Differences for Emotion Oriented Coping

Significant differences between clusters were found in the Emotion Oriented subscale of the CISS at 3-month follow-up ($F = 45.14$; $p < 0.001$; effect size = 0.63; see Table 3). The post hoc analysis showed statistically significant differences between all three cluster groups. Participants with the High-Risk (cluster 3) profile had the highest scores, and participants with the Low-Risk (cluster 1) profile had the lowest scores on Emotion Oriented coping.

3.3. Cluster Differences for Task Oriented Coping

Significant differences between clusters were found in the Task Oriented subscale of the CISS at 3-month follow-up ($F = 11.81$; $p < 0.001$; effect size = 0.38; see Table 3). Participants with the Low-Risk (cluster 1) profile reported significantly higher scores on task-oriented coping than those with the Medium-Risk (cluster 2) and High-Risk (cluster 3) profiles. No statistically significant differences were found between Medium-Risk and High-Risk profiles on Task Oriented Coping.

Table 3. Emotion-Oriented, Task-Oriented and Avoidant Coping at 3-month follow-up, and Post-traumatic Stress Disorder Symptoms and each subscale of Post-traumatic stress Disorder symptoms at 3-month and 12-month follow-up by cluster group.

	N	Mean (SD)	Lower than	Higher than
Emotion-Oriented Coping				
1. Low-Risk	61	15.81 (5.12)	2 *** 3 ***	
2. Medium-Risk	60	20.02 (4.67)	3 ***	1 ***
3. High-Risk	25	26.32 (3.65)		1 *** 2 ***
Task-Oriented Coping				
1. Low-Risk	61	32.31 (5.70)		2 *** 3 ***
2. Medium-Risk	60	28.24 (5.07)	1 ***	
3. High-Risk	25	27.38 (5.74)	1 ***	
Avoidant Coping				
1. Low-Risk	61	24.02 (8.19)		2 *
2. Medium-Risk	60	20.95 (5.85)	1 *	
3. High-Risk	25	21.06 (5.79)		
Post-traumatic Stress Symptoms at 3-month follow-up				
1. Low-Risk	61	6.90 (6.86)	2 * 3 ***	
2. Medium-Risk	60	11.57 (10.81)	3 **	1 *
3. High-Risk	25	19.20 (13.07)		1 *** 2 *
Re-experiencing at 3-month follow-up				
1. Low-Risk	61	1.80 (2.98)	3 **	
2. Medium-Risk	60	2.97 (4.64)		
3. High-Risk	25	5.12 (4.82)		1 **
Avoidance at 3-month follow-up				
1. Low-Risk	61	1.52 (2.95)	3 ***	
2. Medium-Risk	60	3.18 (3.97)		
3. High-Risk	25	6.44 (1.29)		1 ***
Hyperarousal at 3-month follow-up				
1. Low-Risk	61	3.54 (2.96)	2 * 3 ***	
2. Medium-Risk	60	5.42 (4.62)	3 *	1 *
3. High-Risk	25	7.88 (5.39)		1 *** 2 *
Post-traumatic Stress Symptoms at 12-month follow-up				
1. Low-Risk	43	6.79 (7.30)	2 (p = 0.06) 3 *	
2. Medium-Risk	39	11.15 (10.08)		1 (p = 0.06)
3. High-Risk	18	12.83 (6.93)		1*
Re-experiencing at 12-month follow-up				
1. Low-Risk	43	1.49 (2.58)		
2. Medium-Risk	39	2.54 (3.69)		
3. High-Risk	18	2.67 (3.16)		
Avoidance at 12-month follow-up				
1. Low-Risk	43	2.23 (3.46)		
2. Medium-Risk	39	4.00 (4.88)		
3. High-Risk	18	2.44 (3.35)		
Hyperarousal at 12-month follow-up				
1. Low-Risk	43	3.07 (2.81)	3 ***	
2. Medium-Risk	39	4.62 (4.10)	3 *	
3. High-Risk	18	7.17 (3.71)		1 *** 2 *

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

3.4. Cluster Differences for Avoidant Coping

Significant differences between clusters were found in the Avoidant Coping subscale of the CISS at 3-month follow-up (F = 3.43; $p < 0.05$; effect size = 0.22; see Table 3). Participants with the Low-Risk (cluster 1) profile reported significantly higher scores on avoidant coping

than those with the Medium-Risk (cluster 2) profile. No statistically significant differences were found between Low-Risk and High-Risk profiles on Avoidant Coping.

3.5. Cluster Differences for PTSD Symptoms

Significant differences between clusters were found with respect to the CAPS total score at 3-month follow-up (F = 14.10; $p < 0.001$; effect size = 0.41; see Table 3) and at 12-month follow-up (F = 4.36; $p < 0.05$; effect size = 0.29; see Table 3).

At 3-month follow-up, the post hoc analysis showed statistically significant differences between all three cluster groups. Participants with the High-Risk (cluster 3) profile had the highest scores, and participants with the Low-Risk (cluster 1) profile had the lowest scores. At 12-month follow-up, statistically significant differences were only found between clusters 1 (Low-Risk) and 3 (High-Risk). A non-significant difference ($p = 0.06$) was found between clusters 1 (Low-Risk) and 2 (Medium-Risk). No differences were found between clusters 2 (Medium-Risk) and 3 (High-Risk) at 12-month follow-up.

3.6. Secondary Analyses

As can be seen in Table 3, at 3-month follow-up, significant differences were found between clusters regarding each of the CAPS subscales: re-experiencing (F = 5.96; $p < 0.01$; effect size = 0.28), avoidance (F = 11.42; $p < 0.001$; effect size = 0.40) and hyperarousal (F = 10.00; $p < 0.001$; effect size = 0.35). The post hoc analysis showed statistically significant differences between clusters 1 (Low-Risk) and 3 (High-Risk) for all three subscales. Additionally, cluster 3 (High-Risk) showed statistically higher hyperarousal scores than cluster 2 (Medium-Risk).

At 12-month follow-up, differences were statistically significant for the hyperarousal subscale (F = 8.68; $p < 0.001$; effect size = 0.39) only. The post hoc analysis showed that participants with the High-Risk (cluster 3) profile reported significantly higher hyperarousal scores than those with the Low-Risk (cluster 1) or Medium-Risk (cluster 2) profiles. No statistically significant differences were found between clusters 1 and 2.

4. Discussion

To the best of our knowledge, the present study is the first to examine specific personality trait typologies and their respective relations to PTSD symptoms and coping strategies. Its aims were twofold: First, we identified empirically derived subtypes of personality traits in a sample of ACS patients on measures of TDP, alexithymia and resilience. Second, we identified whether these particular typologies were differently associated with ACS-induced PTSD symptoms, including PTSD symptoms subscales, and potentially adaptive or maladaptive coping styles.

Three clusters were identified, and the final three-cluster solution included a Low-Risk cluster with patients scoring high in resilience and low in alexithymia with no TDP; a Medium-Risk cluster with patients scoring with an average level of resilience and alexithymia, and no TDP personality; and a High-Risk cluster with patients showing low resilience, high alexithymia, and TDP. Associations of PTSD symptoms with the personality traits were only found at 3-month follow-up, except for resilience. This might be because alexithymia and TDP might partially reflect responses to the traumatic event and change over time [31,32]. However, these previous studies were performed in individuals with different types of trauma. Further studies are needed to investigate if alexithymia and TDP manifest as a response to ACS or simply yield patients more vulnerable to the development of PTSD symptoms.

We identified adaptive and maladaptive profiles for PTSD symptoms in the aftermath of ACS. When examining the maladaptive profile in conjunction with PTSD symptoms subscales, the subtype characterized as High-Risk exhibited the highest levels of PTSD symptoms at 3 months post-ACS and 12 months post-ACS. Conversely, the profile characterized as Low-Risk constituted a "resilient" group (i.e., lower levels of alexithymia), while the Medium-Risk subtype exhibited moderate levels of PTSD symptoms. This is consistent

with existing literature suggesting that neuroticism, which is positively associated with TDP and alexithymia and negatively associated with resilience, was predictive for PTSD following acute MI [6]. Moreover, a high manifestation in alexithymia and TDP may impede the development of social support after the traumatic event [33,34]. In turn, social support has been related to increased morbidity and mortality and increased cardiac risk in the aftermath of an ACS [35]. TDP is associated with social alienation, a higher number of reinfarction, mortality rates and vital exhaustion [36]. Additionally, patients with high alexithymia and TDP may refuse to attend cardiac rehabilitation and have increased non-adherence to treatment. The results also support the idea of Taylor and Bagby [37], who concluded that alexithymia is associated with maladaptive coping mechanisms [37]. Patients with a lack of awareness of their feelings are less able to cope with emotional reactions to a traumatic event, so that emotional distress may not be reduced and may thus result in PTSD symptoms [38].

On the other hand, high resilience seems to protect from developing PTSD symptoms [39]. Previous research found that resilient patients are at lower risk of developing acute stress disorder and PTSD symptoms [15]. Studies have shown that resilience is associated with higher adherence with treatment recommendations, health-related quality of life, pain severity, exercise adherence and even physical outcomes such as HbA1C [40]. Instead of PTSD symptoms, patients reported personal growth when they were confronted with a physical illness [40]. Enhancing resilience through psychotherapeutic methods such as mindfulness-based therapies may help to increase long-term effects such as medication adherence and provide a better cardiovascular outcome in highly distressed patients. It remains unclear whether resilient patients can cope better with the ACS or perceive the event as less harmful. A more thorough investigation of the perception of the ACS may be investigated in future studies.

To further validate our cluster results, we tested the associations between personality typology and coping styles. Our personality typologies differed significantly in terms of emotional coping style, with the High-Risk profile exhibiting the highest levels of emotion-oriented coping. Conversely, the Low-Risk group showed the lowest level of emotion-oriented coping and a strong link with low ACS-induced PTSD symptoms, in line with previous studies [41]. Lazarus and Folkman [18] suggest that coping strategies are cognitive and behavioral efforts to manage internal and external problems and to maintain a feeling of control. A more emotion-oriented coping style may lead to being overwhelmed by feelings that cannot be regulated when the situation is out of personal control. In combination with higher levels of alexithymia, which is associated with deficits in emotion regulation, it might be suggested that patients are unable to cope with the unexpected and sudden occurrence of an ACS [41]. Moreover, emotion-oriented coping was found to be negatively associated with resilience [42]. Further evidence of this solution is demonstrated by the cluster differences in task-oriented coping. Participants with low-risk typologies showed higher levels of task-oriented coping that has been found to be positively related to resilience [43]. This might support the assumption that patients with an ACS benefit from a task-oriented coping style that allows them to solve the problem actively. Further research should focus on therapeutic approaches to enhance self-efficacy and active problem-solving strategies. Additionally, this might explain why debriefing is not useful in reducing PTSD symptoms in the aftermath of a traumatic event [44]. Avoidance-oriented coping was positively associated with resilience in patients in the Low-Risk cluster. This finding is in line with a study showing that patients with a repressive coping style are more likely to experience less acute stress and subsequent PTSD than patients who had a more non-repressive coping style. Moreover, repressive strategies are effective in reducing PTSD symptoms in the short-term and even in the long-term [45]. There are several explanations that may account for this finding. Patients with avoidance-oriented coping are more likely to perceive less threatening cues of the ACS. This could have a protective function following a traumatic event. Another explanation is that avoidance helps to maintain a positive self-image [45]. It is still not clear if the coping style is a manifestation of PTSD symptoms or

a predictor for PTSD symptoms. Following the assumption of Alonzo and Reynolds [46], ACS-patients may have a spectrum of posttraumatic challenges that affects the way they cope. MI patients with a vulnerability for a maladaptive coping style may, for instance, refuse to take medication or strive for help when they have recurrent cardiac symptoms, leading to an increased risk for morbidity and mortality.

Finally, the core implication of the study comprises the clinical implication that patients with a high-risk profile should be detected in order to prevent potentially negative clinical outcomes such as PTSD symptoms. In clinical populations such as the target of our study (patients who have suffered an ACS), major variability may exist regarding patient characteristics, symptom severity, or treatment responses and prognosis. Better understanding such heterogeneity and how some variables may appear associated with others could help in developing more effective treatments and a more personalized attention to better suit patient profiles [47]. This way, clinicians could address their interventions more specifically to those patients with greater risk earlier, hence approaching it from a preventive point of view.

Future studies evaluating the role of personality traits in the development of ACS-induced PTSD symptoms would be useful in understanding recovery after ACS as well as potential targets for intervention. More research is needed to investigate whether these personality traits act as a consequence of the ACS or increase the risk of developing maladaptive coping strategies.

5. Limitations

Our study has a number of limitations. Firstly, we only included highly distressed patients in the study, meaning that they scored high in pain, fear of dying and/or helplessness during ACS. Possibly, this is already a subgroup of vulnerable patients who have different coping styles and altered (i.e., more vulnerable) personality traits. On the other hand, it is important to focus on this homogenous sub-population because they are at increased risk for developing PTSD symptoms.

Secondly, the present study is cross-sectional, and the direction of causation cannot be inferred. We treated the personality traits as dispositional factors and only measured them once. Alternatively, these traits might be responses of the acute ACS. Therefore, longitudinal studies of personality typologies in relation to PTSD symptom development and maintenance are needed.

Thirdly, the present study was a secondary analysis of a randomized controlled trial to prevent the development of ACS-induced PTSD symptoms, possibly limiting the generalizability of our findings.

6. Conclusions

The present study represents an important next step in understanding the relationships among different personality traits, coping strategies and PTSD symptoms following ACS. The identified typologies and respective relations to PTSD symptoms and coping strategies highlight the potential transdiagnostic utility of examining these personality traits in patients after ACS in relation to psychiatric symptoms. Maladaptive personality traits such as TDP and alexithymia may impact the psychological adjustment following ACS. Therefore, future studies should investigate whether offering techniques to increase resilience and active problem-solving strategies will reduce PTSD symptoms in ACS patients.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/psych4040057/s1, Figure S1: Cluster dendogram using Ward method; Table S1: Bivariate correlations (associations) between variables; Table S2: Crosstab for clinically significant posttraumatic stress disorder symptoms at 3-month follow-up and 12-month follow-up.

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Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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