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Is denial a maladaptive coping mechanism which prolongs pre-hospital delay in patients with ST-segment elevation myocardial infarction?

Findings from the multicenter MEDEA Study

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ABSTRACT

Objective: During an acute myocardial infarction, patients often use denial as a coping mechanism which may provide positive mood regulating effects but may also prolong prehospital delay time (PHD). However, empirical evidences is still sparse.

Methods: This cross-sectional study included 533 ST-elevated myocardial infarction (STEMI) patients from the *Munich Examination of Delay in Patients Experiencing Acute Myocardial Infarction (MEDEA)* study. Data on sociodemographic, clinical and psycho-behavioural characteristics were collected at bedside. The outcome was assessed using the Cardiac Denial of Impact Scale (CDIS) with the median split as cutoff point. A total of 206 (41.8%) STEMI patients were thus classified as deniers.

Results: Deniers were less likely to suffer from major depression (p=0.04), anxiety (p=0.01) and suboptimal well-being (p=0.01) compared to non-deniers during the last six months prior to STEMI. During STEMI, they were less likely to perceive severe pain strength (p=0.04) and racing heart (p=0.02). Male deniers were also less likely to perceive shortness of breath (p=0.03) and vomiting (p=0.01). Denial was not associated with overall delay time. However, in the time window of 3 to 24 hours, denial accounted for roughly 40 minutes extra delay (356 vs 316.5min p=0.02 n=196).

Conclusions: Denial not only contributes to less suffering from acute heart related symptoms and negative affectivity but also leads to a clinically significant delay in the prevalent group.

Abstract Word Count: 220

Keywords: denial; behaviour response; decision time; prehospital delay.

Abbreviations:

AMI: Acute Myocardial Infarction, **STEMI:** ST segment Elevation Myocardial Infarction, **PHD:** Prehospital Delay, **MEDEA:** Munich Examination of Delay in Patients Experiencing Acute Myocardial Infarction

Introduction

Denial has been commonly framed as a psychological mechanism for “ego defense” (1) which individuals unconsciously employ as reaction to the confrontation with an unacceptable threatening and a potentially harmful condition by refusing to perceive or consciously acknowledge the impact of a given threat. In the early decades of psychological theory building, denial was regarded as “immature” (1, 2) mainly because subjects with high levels of denial may act maladaptive: rejecting or distorting reality in order to defend against unacceptable impulses. More recently, however, positive aspects of denial as a coping mechanism have been acknowledged by highlighting the provision of psychological protection against the perception and processing of subjectively painful or distressing information (3). Here, denial may facilitate positive mood regulating effects when facing traumatic events and may enhance resilience in these subjects.

An acute myocardial infarction (AMI) with its traumatizing and life threatening onset (4) may qualify as a condition where denial may serve as a prominent maladaptive coping mechanism (4-6). Indeed, some small exploratory studies, mainly performed over 10 years ago, provided a preliminary evidence that denial contributes to delayed adherence to effective cardiac treatment by disavowing of the diagnosis and by minimizing the perceived symptom burden and symptom severity (7-9). However, it is not unlikely that denial also exerts positive effects during the acute stress situation of an AMI. Indeed, one recent study has demonstrated that denial can also help patients to go through stressful somatic disease treatment conditions and react better to the medical treatment (10).

The suspicion that denial may act on the patient’s decision to seek adequate help after the onset of an ST-segment-elevation myocardial infarction (STEMI) is of a particular concern because patient’s delay in presenting to the hospital promptly after STEMI onset is a major factor limiting the potential of acute reperfusion to further reduce

cardiovascular mortality (6). Denial has the potential to play an important role in this context. Given the limited evidence on this topic, we aimed to investigate whether a high level of denial exert an independent impact on prolonged delay time during STEMI. Furthermore, we investigate whether denial facilitates a favorable impact on mood regulating conditions (depression, anxiety) and the perceived severity of the STEMI.

Methods

The multicenter, retrospective cross-sectional MEDEA study (*Munich Examination of Delay in Patients Experiencing Acute Myocardial Infarction*) was conceived with the aim to evaluate prehospital delay of STEMI patients, and the factors which may contribute to prolonged delay.

Study design

The patients were recruited from the university or municipal hospitals, which have a coronary care unit and belong to the Munich emergency system network hospitals (see the acknowledgement). The main inclusion criterion was the diagnosis of STEMI as evidenced by typical clinical symptoms including: chest pain/discomfort lasting for 10–20 min or more (not responding fully to nitroglycerine), radiation of the pain to the neck, lower jaw, or left arm, dyspnea, or syncope (11); ECG changes and myocardial biomarkers levels (12). Patients were excluded from the study if they had to be resuscitated, if AMI occurred while already hospitalized and if they were unable to answer the questionnaires properly due to language barriers or cognitive impairment. There were no age restrictions.

Standardized operation procedures (SOPs) were implemented to ensure the consecutive referral of eligible patients into the study.

All patients were informed of the aim and procedures of the study and also that taking part in the study would have no effect on their treatment. All participating patients were required to sign a declaration of consent. Physicians updated MEDEA personnel twice a

week on eligible patients. Bed-side interviews were conducted in the hospital ward within 24 hours after referral from intensive care.

Sample

From 12.12.2007 until 31.05.2012, a total of 755 patients were screened for eligibility. In 619 patients, a diagnosis of STEMI was confirmed. As can be seen in Figure 1, approximately 18% of patients were excluded: 4% due to not meeting inclusion criteria and 14% due to absence of consent. From the 619 eligible patients, a total of 86 patients were excluded because of missing data in the Cardiac Denial of Impact Scale (CDIS). A drop-out analysis was conducted to compare the baseline information between the patients with (n=533) and without (n=86) valid CDIS data. This analysis demonstrated that the CDIS responders were significantly younger (M_{res}=61.63, $M_{non\text{-}res}$=66.53, p=0.001), better-educated {N_{res}=208(39.02%), $N_{non\text{-}res}$=48(55.81%), p=0.003} and more likely to be employed {N_{res}=278(52.16%), $N_{non\text{-}res}$=26(30.23%), p=0.0002}. No differences in living situation (living alone or not) (p=0.15) and sex (p=0.15) were found between responders and non-responders.

Data collection

The data collection process was divided into three sections. Firstly, a structured bedside interview was conducted with trained personnel. Secondly, a self-administered questionnaire was filled by the patient without supervision. Thirdly, data were collected from the hospitals' patient charts.

The hospital patient charts and bedside interviews provided data on demographic information, like age, sex, living situation (living alone or not), risk factors, presenting symptoms, important clinical measures as well as possible complications. Prodromal symptoms were defined by the presence of any symptom related to coronary artery disease within the last six months prior to STEMI, including prodromal chest pain, dyspnea, sweating, palpitation, faint, sleep disturbance and fatigue.

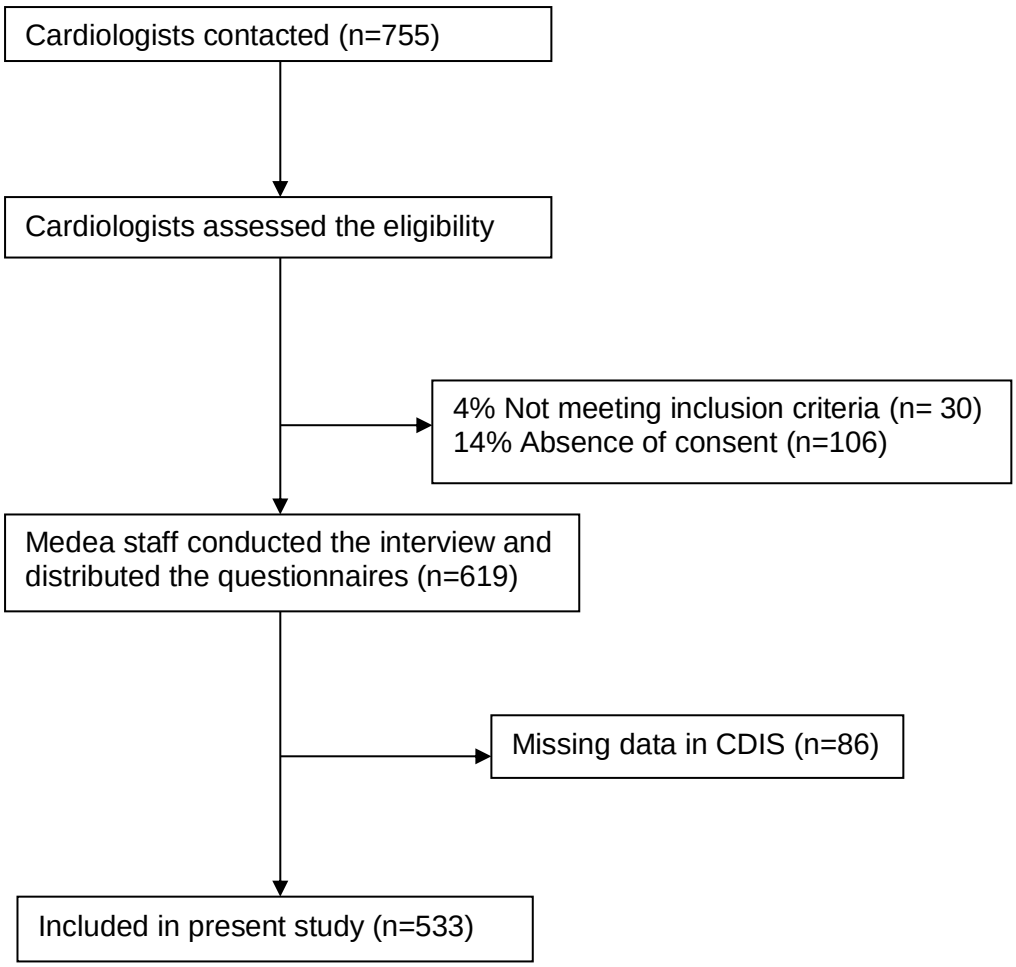

Fig.1 Consort chart of patients in MEDEA.

Measures

Prehospital Delay (PHD)

Patients were asked to recall at what time acute symptoms began. The time difference between symptom onset and first ECG at hospital entry constitutes “prehospital delay” (PHD), measured in minutes. PHD was thus available as a continuous variable which was heavily left-skewed and did not approximate a normal distribution after log-transformations.

Cardiac Denial of Impact Scale (CDIS)

Denial was assessed with the CDIS (13), which originated from the earlier work of Hackett and Cassem (14). The CDIS is composed of 8 items, rated on a 5-point Likert scale from not present to very high, leading to an overall score ranging from 8 to 40. The test-retest reliability, construct and discriminant validity have been reported by the developers (13) as sufficient .

To define an index study population of deniers, we followed the procedure of earlier investigations which applied the median split as a cut-off point (7, 9), leading to a denial (>24) and non-denial (<=24) group. Interestingly, this particular cut off point was identical with the two other studies under consideration (7, 9), indicating that the scale is stable across diverse study population.

Psychological measures

Anxiety was assessed with the German version of Generalized Anxiety Disorder scale (GAD-7). It is composed of 7 items, rated on a on a 5-point Likert scale from not present to very high, leading to an overall score ranging from 7 to 35. A GAD-7 score greater than or equal to 10 indicates anxious participants (15).

Depression was assessed with the Major Depression Inventory (MDI) - a self-report mood questionnaire able to generate an ICD-10 or DSM-IV diagnosis of clinical depression. The MDI contains 12 items. According to the DSM-IV definition, patients who had at least five symptoms in the MDI scale, of which at least one must be a ‘core’ symptom, were diagnosed with major depression (16).

Well-being was evaluated through the WHO-Five Well-Being index. It contains five items on a 6-point scale that range from 0 to 25. Thereafter, the raw scores are transformed into a scale that range from 0 to 100. (17).WHO-5 score less than or equal to 50 indicates suboptimal well-being(18). Effectiveness of the index has been supported in evaluation of emotional well-being in patients with cardiovascular diseases

Type D personality was assessed by DS14 with two subscales containing one assessing negative affectivity and the other assessing social inhibition. Both scales included 7 items ranging from 0 (false) to 4 (true) (19). Type D personality was identified if both subscales scored ≥ 10 points (20).

Patient behavioral responses to STEMI

The structured bedside interview also includes a German version of the Response to Symptoms Questionnaire (21), which assesses the behavior and subsequent reactions of both the patient as well as witnesses in the following areas: social context in which symptoms occurred and bystanders responses, behavioral responses to the symptoms, cognitive responses to the symptoms and emotional responses to the symptoms. The instrument also includes one item on symptom expectation, which measures the congruence between symptom expectation and perception (11 items, 5 point Likert scale, >3 rated was used as cut-off to define a high level).

Data analysis

Differences between dichotomous variables were assessed using the Chi-square test. When comparing ordinal variables with more than two outcomes, the Mantel–Haenszel Chi-square test was used. Differences in age were assessed using the t-test. The non-parametric Wilcoxon test was used for assessing differences in median prehospital delay times. Pearson correlation was used for assessing the dose-response relationship between denial level and delay time. A total of 22 patients were excluded from the multivariate analysis due to missing values in covariates. No significant differences were found between the included and the excluded patients

All statistical analyses were run in SAS (Version 9.2, SAS-Institute Inc., Cary, NC, USA). The significance level was set at $p<0.05$. The analysis and description in this paper follow the STROBE guidelines for cross-sectional studies (22).

Results

A total of 533 patients were included in the present study with 134 (25.14%) women and 372 (69.79%) men aged between 30 and 93 years (mean age 61.68ys SD=12.20). In the total sample, the median delay was 203 (101.5-695.0) minutes.

Prevalence and distribution of denial in patients with STEMI

The CDIS score was normally distributed with a mean of 23.61±5.16 and a median of 24 leading to a total of 224 (42.03%) patients as denier (CDIS>=24). As shown in **Table I**, patients with higher levels of denial were more likely to be younger (p=0.03, 60.52 ±12.07 vs 62.77±12.11), male (p=0.01), living with someone (p=0.01) and were less likely to suffer from prodromal symptoms (p=0.01). Furthermore, patients with higher levels of denial were less likely to suffer from depressive mood (p=0.04), anxiety (p=0.01) and suboptimal well-being in the six months prior to STEMI (p=0.01).

As also can be seen in **Table I**, there were no significant differences between patients with a high level of denial and those with a low level of denial regarding educational levels, employment status and the presence of cardiac risk factors. Furthermore, when considering the medical history of the post-acute infarction phase (intensive care, complications and cardiac arrest), we also did not observe any significant differences in denial levels, suggesting that the severity of the infarction had no significant association with denial.

Table I. Sociodemographic and clinical characteristics of the study population stratified by denial (n=224) and non-denial (n=309) and by sex.

	Cardiac denial of impact scale (n=533)			P value		
	Missing	Denial	Non-denial	Overall	Women	Men
Socio-demographic Factors						
Sex (Female)	-	43(32.09)	91(67.91)	**0.01**		
Sex (Male)	-	181(45.36)	218(54.64)			
Living alone	-	50(22.32)	101(32.69)	**0.01**	0.38	**0.04**
Employed	-	126(56.25)	141(49.19)	0.11	0.28	0.07
Education (secondary school and above)	-	82(36.61)	126(40.78)	0.33	0.07	0.93
Psychological Factors						
Depressed mood	10	94(41.96)	164(53.07)	**0.04**	0.16	**0.05**
GAD (score >10)	0	20(8.93)	51(16.50)	**0.01**	**0.04**	0.07
Suboptimal well-being (Score<50)	-	51(22.77)	93(33.01)	**0.01**	0.31	**0.02**
Somatic Risk Factors						
Hypertension	5	128(57.40)	190(62.30)	0.26	0.30	0.50
Hypercholesterolemia	5	73(32.88)	122(39.87)	0.10	0.86	**0.04**
Diabetes Mellitus	6	47(21.36)	55(17.92)	0.32	0.88	0.28
Smoking	1	129(57.59)	183(59.42)	0.67	0.74	0.44
Obesity	5	78(35.14)	91(29.74)	0.41	0.09	**0.02**
Family history of MI	2	107(47.98)	155(50.32)	0.59	0.76	0.69
Medical History						
Prodromal symptoms*	-	135(60.27)	219(70.87)	**0.01**	0.25	**0.03**
Stent history	4	14(6.31)	27(8.79)	0.29	0.51	0.35
MI history	-	21(9.38)	43(13.92)	0.11	0.46	**0.02**
Post-acute Course						
Intensive care $\geq$ 3 days	5	152(68.47)	199(65.03)	0.41	0.96	0.34
Any complications	-	40(17.86)	56(18.12)	0.94	0.16	0.40
Cardiac arrest	-	11(4.91)	10(3.24)	0.33	0.76	0.26

Values are n (%). Bold means significant p values at <0.05 level. Abbreviations: MI= myocardial infarction; GAD=generalized anxiety disorder.

*Prodromal symptoms include: prodromal chest pain, dyspnea, sweating, palpitation, faint, sleep disturbance and fatigue

The association between denial and patients' cardiac symptom perception and behavior responses during STEMI

In the face of acute STEMI, deniers tended to perceive lower pain strength (p=0.04), less racing heart (p=0.02) and were less likely to recognize the symptoms as signs of MI (p=0.01), as can be seen in **Table II**. Men but not women with high levels of denial reported less shortness of breath (p=0.03), vomiting (p=0.01) and perceived their cardiac risk as less serious (p=0.05). Female deniers tended to attribute their symptoms less often to their heart (p=0.03).

As can be seen in Table II, we observed only minimal differences between deniers and non-deniers concerning their behavioral reactions to symptom onset. However, deniers were more likely to keep on doing ongoing activities (p=0.03), but tended to alarm the emergency system more often (p=0.09). Female deniers were more likely be driven by others (p=0.05) compared to driving on their own (p=0.03).

Table II. Patients' responses and behavioral patterns in the study population, stratified by denial (n=224) and non-denial (n=309) and by sex.

	Patients responses and behavior patterns			P value		
	missing	denial	non-denial	overall	women	men
Presenting symptoms						
Chest pain	-	201(89.73)	273(88.35)	0.21	0.76	0.57
Sweating	-	124 (55.36)	188 (60.84)	0.08	0.16	0.37
Shortness of breath	-	63 (28.13)	111 (35.92)	0.06	0.42	**0.03**
Vomiting	-	23 (10.27)	47 (15.21)	0.10	0.76	**0.05**
Exhaustion	-	33 (14.73)	42 (13.59)	0.71	0.08	0.59
Racing heart	-	13 (5.80)	33 (10.68)	**0.05**	0.83	**0.05**
Typical symptoms（>2）	-	53 (23.66)	91 (29.45)	0.14	0.39	0.28
Evaluation of symptoms						
Pain strength (score ≥ 8)	8	102 (46.58)	170 (55.56)	**0.04**	0.07	0.25
Low symptom severity (yes vs. no)	3	124 (64.50)	185 (55.70)	0.06	0.13	0.17
Low risk perception (high vs. low)	26	192 (89.72)	249 (84.98)	0.12	0.21	**0.01**
Symptom recognition as MI (high vs. low)	7	90 (40.54)	156 (51.32)	**0.01**	0.42	**0.01**
Attribution to the heart	4	127 (57.47)	155 (50.32)	0.10	**0.03**	0.40
Patients' reactions to the symptom onset						
Waiting for the symptoms to resolve	1	142 (63.39)	190 (61.69)	0.69	0.94	0.62
continuing doing ongoing activities	1	54 (26.20)	53 (18.50)	**0.03**	0.17	0.09
Trying to relax	2	84 (37.67)	128 (41.60)	0.37	0.86	0.36
Calling someone for help	1	14 (6.25)	19 (6.17)	0.97	0.87	0.81
Calling a general physician	-	19 (8.48)	32 (10.39)	0.46	0.78	0.33
Dispatching the emergency system	1	91 (40.63)	107 (34.74)	0.17	0.09	0.49
Transportation to the hospital						
Via ambulance	-	92 (41.26)	122 (36.91)	0.70	0.42	0.50
Via other drivers	-	14 (6.25)	11 (3.56)	0.17	**0.05**	0.52
Self-driving	-	52 (21.68)	67 (23.21)	0.45	**0.03**	0.24

Values are n (%). Bold means significant p values at <0.05 level. Typical symptoms include chest pain, sweating, vomiting, and shortness of breath.

The impact of denial on prehospital delay

As can be seen in Table III, the median overall delay time in deniers was 216 mins and in non-deniers 200 mins, not reaching a significant difference. When we stratified the data, we found no significant difference in either sex groups.

Figure 2, displaying the cumulative frequency curve of the prehospital delay of deniers and non-deniers, shows an overall discrete distribution of two groups, proving a slight yet nevertheless non-significant difference from deniers. However, inspection of the figure disclosed a significant 40 mins extra delay (356 vs. 316 mins) in denial group in the time window ranging from 3 to 24 hours.

Correlation analysis between increasing levels of delay and increasing delay time disclosed a dose-response relationship (r=0.16 p=0.02) (see appendix A)

Table III. Median pre-hospital delay time in minutes in the study population, stratified by denial

		median delay			median delay					
		in all patient		p	in women		p	in men		p
		N	median		N	median		N	median	
Delay(min)	Denial	224	216 (104.5-808.5)	0.26	43	249 (120-1087)	0.22	181	196 (104-728)	0.46
	No Denial	309	200 (97-504)		91	213 (93-450)		218	182 (98-512)	
Delay between 3-24hr(min)	Denial	80	356 (240.5-686)	**0.02**	17	380 (249-644)	**0.05**	63	340 (240-692)	0.19
	No Denial	116	316.5 (223.5-484)		42	266 (213-359)		74	352 (224-504)	

Values are medians (25%quantile -75%quantile). Bold significant P values at<0.05 level

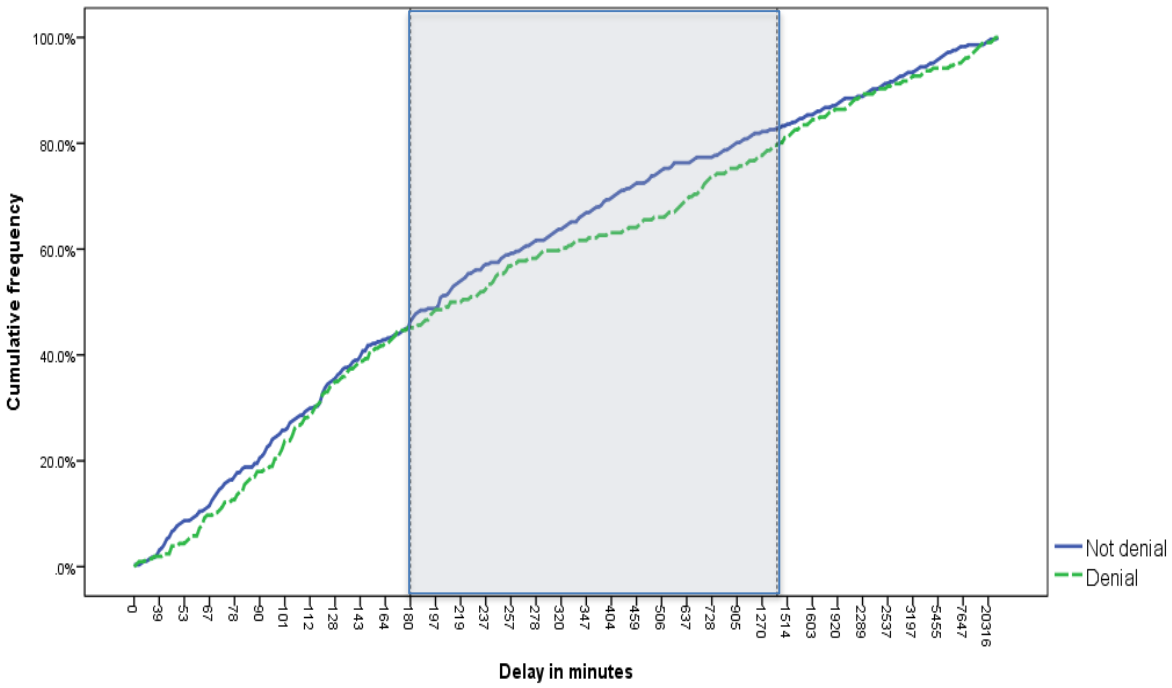

Fig. 2 Cumulative frequency distribution curves for prehospital delay among patients with (dash line) or without denial (solid line) in different time windows. There are no significant differences between patients with or without denial (Median: denial 216: vs. not denial 200 minutes; p value=0.26). For patients who delayed between 3 hours to 24 hours, patients with denial delayed approximately 40 minutes longer than patients without. (Median: denial 356 vs. not denial 316.5 minutes; p value=0.02)

In sensitivity analysis, we additionally investigated differences in symptom perception in three time windows of delay: delay <3 hours, delay 3-24 hours and delay >24 hours. As can be seen in **Table IV**, we observed dose-response relationships between delay time and symptom perception; with increasing delay time, perception of typical symptoms (shortness of breath, sweating, chest pain, vomiting) (p=0.02) and symptom severity (p=0.0001) decreased. In the most favorable time window of <3 hours, deniers and non-deniers exhibited no significant differences in perceived symptom burden (23.27 vs. 23.66 p=0.58) or symptom severity (23.40 vs.23.59 p=0.79).

Table IV. Symptom perception during acute myocardial infarction and subsequent delay times, stratified by 3 time windows

		delay time(n=533)			
	missing	delay<3hr	delay 3-24hr	delay>24hr	P
typical symptom(>=3)	-	77(31.95%)	50(25.51%)	18(17.71%)	**0.02**
symptom severity (>=3)	3	170(70.54%)	104(53.33%)	48(51.06%)	**0.0001**
pain strength(>8)	8	128(53.78%)	99(51.30%)	45(47.87%)	0.61

Values are n (%). Bold significant P values at<0.05 level

Discussion

The impact of denial on delay time

Denial is a concept often encountered to describe a psychological mechanism of defense which serves to provide protection against perception and processing of subjective traumatizing or painful properties of a given event (3) (5). On one hand, given the possible traumatizing consequences of AMI, denial might be favorable on the occasion, on the other hand, in patients who employ denial as their dominant means of coping with distressing events, they could be assumed to ignore reality and delay acute coronary care when facing with STEMI. However, the first major finding of this investigation in a sample of 533 STEMI patients showed that patients characterized as deniers exhibited only minimally longer overall delay times to reach the coronary care unit of a hospital compared to non-deniers (216 vs 200 min). This time difference did not reach significance.

On a first view, this finding seems to be surprising not only because of the theoretical framework of denial as a psychological mechanism to disavow clinical realities but also because preliminary evidence suggests a significant impact of denial on a prolonged delay time. To the best of our knowledge, only 3 studies with small sample sizes have investigated this topic so far: O'Carroll et al. (2001) analyzed the impact of denial on delay in 85 AMI patients and demonstrated that denial had a significant (however

clinically small) effect on delay (with a cut-off point of 4 hours) (7). The replication study of Stenström et al. (2005) with 107 AMI patients and the identical cut-off-point confirmed a longer delay time in deniers (8). Perkins-Porras et al. (2008) with a more meaningful cut-off point of 130 mins were the first to demonstrated a borderline significant effect of denial on delay {Odds ratio: 1.12(1.00-1.25), p=0.05} (9). Nevertheless, this study included only 177 patients (compared to 533 patients in the present analysis) and also accepted patients with NSTEMI and unstable angina (contrary to the present study with a homogeneous sample of STEMI patients).

A second interesting finding in the present investigation confirmed a clinically relevant median excess time of 40 mins in deniers compared to non-deniers in the time window of 3 to 24 hours (similar to the earlier studies (7, 8)).

The examination of potential differences between the impact of denial on delay in the time window of <3 hours and 3-24 hours (and additionally in the delay time of >24hours) revealed that patients within the most favorable <3 hours time window had experienced substantially higher symptom burden and symptom severity which suggests that the drastic suffering in the acute phase may have overcome the effect of denial on prehospital delay and psychological defense mechanisms may have become secondary (5, 23) (24-27).

Protective effects of denial

The investigation also showed that denial was associated with lower levels of depressed mood, anxiety and with a higher level of well-being, thus confirming conceptual considerations that denial may provide psychological protection against negative affectivity (28). Furthermore, our investigation disclosed that individuals with a higher level of denial tended to report less pain severity, racing heart and shortness of breath. The data did not provide any indications that deniers were different from non-deniers in terms of objective severity of the infarction: no significant difference emerged concerning

length of intense care, incidence of cardiac arrest, or complications during the post-acute course. The frequency of recurrent infarctions was even higher in non-deniers. This is note-worthy because it is unlikely that the infarction in deniers was less severe.

The impact of denial on patients' behavior at STEMI onset

There is a general concern that denial may prompt the refusal to admit the clinical reality and thus deniers may fail to seek adequate medical attention and behavioral consequences confronting myocardial infarction(29) (30). The present investigation is, to the best of our knowledge, the first to show in a large data set that the patients' reactions to symptom onset for deniers compared to non-deniers were not different in most aspects: the majority of both patient groups decided inadequately as their first reaction… "*To wait till the symptoms resolved*" (in about 60% of cases) and they "*tried to relax"* (in about 40% of cases). However, more deniers than non-deniers used to "*keep on continuing ongoing activities*" (which is a further non-adequate behavior) but there was also a strong tendency of deniers, yet not significant, to activate the emergency ambulance system as their first step to release the chain of survival.

Characteristics of deniers

No other study so far has investigated the sociodemographic and clinical characteristics of a "typical" denier with a coronary heart disease condition. Deniers in the present study were more likely to be younger and to be male. Exactly these features are generally known to contribute to early arrival at the hospital (31). This holds true also for a third significant characteristics of deniers; they are less likely to live alone, which likewise contributes to less delay (32, 33) .

Limitations

To our knowledge, this is the first study investigating the impact of denial on PHD in a strictly defined population (STEMI). There are a few study limitations that are worth considering. First, data on PHD were collected retrospectively, and thus there is a potential for recall bias. However, all data were collected at bedside within a very narrow

time frame after STEMI. We had relatively small numbers of women, so replications of these results in larger datasets are warranted. Furthermore, selection bias could have resulted from excluding STEMI patients who died before reaching the hospital. The instrument we chose to measure denial did not cover overt denial items, which may have excluded patients with extreme denial, but the normal distribution of the denial score shows its ability to differentiate the denial level in cardiac patients.

Conclusion

Our study contributes important new findings to the role of denial in the face of an AMI in an extended data set of STEMI patients. First, the psychological coping mechanism of denial in the face of an AMI turned out to have more beneficial than adverse effects: denial contributed to less suffering from heart-related symptoms and negative potentially traumatizing affectivity without leading the patients to maladaptive behavior (e.g. waiting for the symptoms to resolve). In addition, from an overall perspective, denial only minimally increased the delay time, whereas in the time window of 3-24hrs, denial led to a clinical significant longer delay. Apparently denial did not function in the most favorable time window presumably because of an extreme painful symptom pattern which overcame the effect of denial on prehospital delay. In this case, denial might be an intervention point for those who are without severe symptoms. However, this study was not designed for evaluating the long term consequences of AMI. Potential determinants of the relationship between denial and long term prognosis should be explored. Evidence shows that deniers were less likely to participate in post-AMI cardiac rehabilitation programs (29) or avoid cardio-protective health behaviors including treatment adherence (34, 35).Therefore, the concept of denial should be addressed in anamnestic interviews with patients in order to give advice for future behavior of patients at risk of a recurrent infarction.

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Conflicts of interest

None to declare

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