Published in final edited form as:

Int J Cardiol. 2017 August 01; 240: 87–89. doi:10.1016/j.ijcard.2017.03.102.

Acute stress disorder symptoms after evaluation for acute coronary syndrome predict 30-day readmission

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Abstract

Background—Thirty-day readmissions are a major concern for hospitals. Even though numerous readmission risk prediction models have been developed, their performance has been modest, and few predictors are modifiable. Stress is a modifiable factor that may increase risk of adverse post-hospitalization outcomes. We examined whether posttraumatic stress days after evaluation for acute coronary syndrome (ACS)—termed acute stress disorder (ASD) symptoms—was associated with 30-day all-cause emergency department (ED) and hospital readmission.

Methods—Participants were enrolled in the REactions to Acute Care and Hospitalization (REACH) study during ED evaluation for ACS. During inpatient stay or by phone after discharge,

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Conflicts of Interest: The authors report no relationships that could be construed as a conflict of interest.

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participants reported ASD symptoms in response to the event that brought them to the ED. ED or hospital readmissions within 30 days of discharge were determined by research nurse record review. Logistic regression was used to assess the association between ASD symptoms and 30-day ED/hospital readmission.

Results—In the analytic sample of 974 individuals, there were 123 ED/hospital readmissions within 30 days of discharge. A 10-point ASD symptom increase was significantly associated with increased 30-day readmission risk in an unadjusted model [odds ratio (OR)=1.32, $p=.001$] and a model adjusted for demographics, clinical characteristics, and ACS discharge diagnosis (OR=1.24, $p=.03$).

Conclusions—Posttraumatic stress shortly after acute coronary syndrome evaluation may help to understand vulnerability for readmission.

Keywords

Readmission; posttraumatic stress; acute stress disorder; acute coronary syndrome

Introduction

Both costly and common, 30-day readmissions are a major concern for hospitals. Numerous readmission risk prediction models have been developed, but their performance has been modest, and, importantly, few predictors are modifiable [1], [2]. Potentially life-threatening medical events that prompt patients' index hospitalizations, along with experiences during hospitalization, can trigger psychological stress, including posttraumatic stress reactions [3]. Stress is a modifiable factor that may increase risk of adverse post-hospitalization outcomes. We examined whether posttraumatic stress days after evaluation for acute coronary syndrome (ACS)—termed acute stress disorder (ASD) symptoms—was associated with 30-day all-cause emergency department (ED) and hospital readmission.

Methods

The REactions to Acute Care and Hospitalization (REACH) study [3,4] is an observational cohort of patients enrolled during ED evaluation for ACS at New York-Presbyterian/Columbia University Medical Center, a large urban hospital in Northern Manhattan. English- and Spanish-speaking patients with a provisional diagnosis of "probable ACS" were eligible. During inpatient stay or by phone after discharge (median 3 days after enrollment), participants reported ASD symptoms (i.e., early posttraumatic stress symptoms: re-experiencing and/or avoiding reminders of the trauma, hyperarousal) in response to the event that brought them to the ED using 14 items from the Acute Stress Disorder Scale (ASDS; total score range=14-70) [5]. ASDS total scores ≥ 28 suggest probable ASD [5]. ED or hospital readmissions within 30 days of discharge were identified by contacting patients and proactively searching electronic health records, and were confirmed by research nurse record review. Columbia University Medical Center's Institutional Review Board approved this research, and the study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki. All participants provided written informed consent.

Logistic regression was used to determine the association between ASD symptoms and 30-day ED/hospital readmission with and without adjustment for demographics, Global Registry of Acute Coronary Events (GRACE) index for mortality risk [6], Charlson comorbidity index [7], history of coronary artery disease, discharge diagnosis (ACS; non-ACS, cardiac; non-cardiac), and Patient Health Questionnaire-8 depression screen [8]. Missing data were imputed for total scores if <50% of items were missing. Analyses were conducted using R Statistical Software.

Results

From November 2013 to February 2016, 1,000 patients were enrolled in the REACH study (61% of those eligible). Participants who were readmitted before ASD assessment ($n=22$) or died within 30 days of discharge ($n=4$) were excluded from analysis, resulting in an analytic sample of 974 individuals. Participant characteristics are shown in Table 1. Mean ASDS score was 24.39 (standard deviation=10.49). Thirty percent of participants screened positive for probable ASD, 32.0% were confirmed ACS at discharge, and 12.6% had a 30-day ED/hospital readmission.

A 10-point ASD symptom increase (which corresponds to an increase of approximately 1 standard deviation) was significantly associated with increased 30-day readmission risk in the unadjusted model, odds ratio (OR)=1.32 (95% CI, 1.12-1.56), and adjusted model, OR=1.24 (95% CI, 1.02-1.51) (Table 2). Unadjusted and adjusted model results were based on sample sizes of 916 and 869, respectively, due to observations being deleted because of missingness on some variables. Results were consistent when using the dichotomous probable ASD variable: unadjusted OR=1.92 (95% CI, 1.29-2.87), $P=.001$, $n=916$; adjusted OR=1.65 (95% CI, 1.04-2.63), $P=.04$, $n=869$. ACS discharge diagnosis was not significantly associated with readmission. Model estimates were similar in sensitivity analyses in patients with ($n=312$) and without ($n=662$) confirmed ACS at discharge [ACS: unadjusted OR=1.50 (95% CI, 1.12-2.03), $P=.008$, $n=302$; adjusted OR=1.29 (95% CI, 0.91-1.81), $P=.15$, $n=292$; Non-ACS: unadjusted OR=1.26 (95% CI, 1.03-1.55), $P=.03$, $n=614$; adjusted OR=1.24 (95% CI, 0.97-1.58), $P=.09$, $n=577$]. Model estimates in the full sample were also similar in sensitivity analyses predicting ED and hospital readmissions separately [ED readmission: unadjusted OR=1.23 (95% CI, 0.98-1.54), $P=.07$, $n=916$; adjusted OR=1.25 (95% CI, 0.97-1.62), $P=.09$, $n=869$; Hospital readmission: unadjusted OR=1.31 (95% CI, 1.06-1.62), $P=.01$, $n=916$; adjusted OR=1.17 (95% CI, 0.91-1.52), $P=.22$, $n=869$].

Discussion

Individual differences in the psychological stress experienced following ACS evaluation were associated with greater likelihood of 30-day ED/hospital readmission, independent of demographics, clinical characteristics, and ACS discharge diagnosis. ASD symptoms were significantly related to increased readmission risk over and above depression, and depression was not a significant predictor of readmission in the adjusted model. Given these initial findings, it is possible that aspects of posttraumatic stress response that do not overlap with depression (e.g., fear-related responses) may be particularly associated with readmission risk. Further research is needed to directly address this question, however. Limitations

include single-hospital recruitment, modest participation rate, and lack of comprehensive assessment of other psychopathology (e.g., anxiety). ED factors influence acute posttraumatic stress symptom development [3], and posttraumatic stress shortly after ACS evaluation may help to understand vulnerability for readmission. Treating ASD symptoms can prevent adverse psychological outcomes [5] and might reduce readmission risk.

Acknowledgments

This work was supported by grants from the National Heart, Lung, and Blood Institute: R01HL117832, R01HL123368, K01HL130650. The funders did not have any role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

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Highlights

- Thirty-day readmissions are a major concern for hospitals.
- Stress is a modifiable factor that may increase risk of readmission.
- Participants were enrolled during evaluation for suspected acute coronary syndrome.
- Posttraumatic stress was measured days after evaluation for acute coronary syndrome.
- Elevated posttraumatic stress symptoms predicted increased 30-day readmission risk.

Table 1

Participant characteristics for the full sample and according to 30-day ED/hospital readmission status.

Variable	Full Sample (N=974)	30-day Readmission (n=123)	No 30-day Readmission (n=851)	<i>p</i> ^a
	No. (%) or Mean (SD)	No. (%) or Mean (SD)	No. (%) or Mean (SD)	
Demographics				
Age	60.89 (13.15)	60.03 (11.95)	61.01 (13.32)	.40
Female	445 (45.7%)	52 (42.3%)	393 (46.2%)	.42
Race				.07
non-Hispanic White	160 (16.8%)	12 (9.8%)	148 (17.9%)	
non-Hispanic Black	197 (20.7%)	33 (26.8%)	164 (19.8%)	
non-Hispanic Other	64 (6.7%)	10 (8.1%)	54 (6.5%)	
Hispanic	529 (55.7%)	68 (55.3%)	461 (55.7%)	
Diagnosis at discharge				.26
Non-cardiac diagnosis (e.g., musculoskeletal, gastrointestinal)	562 (57.7%)	63 (51.2%)	499 (58.6%)	
Non-ACS, cardiac diagnosis (e.g., atrial fibrillation, hypertensive urgency)	100 (10.3%)	16 (13.0%)	84 (9.9%)	
ACS	312 (32.0%)	44 (35.8%)	268 (31.5%)	
ASD measures				
ASD symptom score ^b	24.39 (10.49)	27.44 (12.41)	23.96 (10.13)	.005
Probable ASD ^c	275 (30.0%)	49 (43.0%)	226 (28.2%)	.001
Covariates				
GRACE index	155.82 (43.51)	156.36 (42.35)	155.75 (43.71)	.88
Charlson comorbidity index	16.64 (4.14)	16.66 (5.18)	16.64 (3.98)	.96
History of CAD	307 (31.5%)	50 (40.7%)	257 (30.2%)	.02
Depression ^d	244 (26.6%)	43 (37.7%)	201 (25.0%)	.004

Note. ED=emergency department. ACS=acute coronary syndrome. ASD=acute stress disorder. GRACE index= Global Registry of Acute Coronary Events index. CAD=coronary artery disease. Bold= $P < .05$.

^a P -value is for the comparison of participants with and without a 30-day ED/hospital readmission.

^b ASD symptom severity total score.

^c Probable ASD defined as an ASD symptom score ≥ 28 .

^d Depression defined as a Patient Health Questionnaire-8 total score >10 .

Table 2

Results from logistic regression model predicting 30-day ED/hospital readmission.

Variable	Unadjusted OR (95% CI) ^a	P	Adjusted OR (95% CI) ^b	P
ASD symptom score ^c	1.32 (1.12-1.56)	.001	1.24* (1.02-1.51)	.03
Age			0.99 (0.97-1.01)	.46
Female			1.20 (0.79-1.84)	.40
Race				
non-Hispanic White			(ref)	
non-Hispanic Black			2.58 (1.21-5.48)	.01
non-Hispanic Other			2.21 (0.87-5.62)	.10
Hispanic			1.89 (0.96-3.76)	.07
GRACE index			1.00 (1.00-1.01)	.51
Charlson comorbidity index			0.98 (0.94-1.03)	.49
History of CAD			1.62 (1.01-2.60)	.04
Diagnosis at discharge				
Non-cardiac diagnosis			(ref)	
Non-ACS, cardiac diagnosis			1.52 (0.81-2.83)	.19
ACS			1.24 (0.76-2.05)	.39
Depression ^d			1.40 (0.86-2.29)	.17

Note. ED=emergency department. OR=odds ratio. 95% CI=95% confidence interval. ASD=acute stress disorder. GRACE index=Global Registry of Acute Coronary Events index. CAD=coronary artery disease. ACS=acute coronary syndrome. Bold= $P<.05$.

^a58 observations deleted from the unadjusted model due to missingness.

^b105 observations deleted from the adjusted model due to missingness.

^cCoefficients are associated with a 10-point increase in ASD symptom score.

^dDepression defined as a Patient Health Questionnaire-8 total score >10.