Persistent Depressive Symptoms and Pain after Cardiac Surgery

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Objective: Our objectives were to describe trajectories of depressive symptoms and pain at hospital discharge and 6 weeks later and to examine the relationship of persistent depressive symptoms to pain. **Methods:** Before and 6 weeks after hospital discharge, 251 patients undergoing cardiac surgery (mean [SD] age = 67.3 [9.5] years; 73% male) completed the Beck Depression Inventory and the Brief Pain Inventory (BPI). Patients were categorized into two groups based on the presence or absence of persistent depressive symptoms (Beck Depression Inventory score >10 at both times). Between-group differences in pain interference (BPI-INT) and pain severity (BPI-SEV) were evaluated using repeated-measures analysis of variance. Linear regressions were performed to determine if changes in depressive symptoms were related to BPI-INT and BPI-SEV, controlling for demographic and clinical data. **Results:** Persistent (16.3%) or worsening depressive symptoms (15.3%) from hospital discharge to 6 weeks were observed; many experienced at least some persistent pain (BPI-INT 67.8%, BPI-SEV 47.8%). From discharge to 6 weeks, patients with persistent depressive symptoms sustained higher levels of BPI-INT ($p < .001$) and BPI-SEV ($p < .003$). In multivariate analysis, only changes in depressive symptoms, not clinical and demographic variables, were related to BPI-INT ($p < .001$) and BPI-SEV ($p = .001$). **Conclusions:** Persistent depressive symptoms are independently associated with continued pain up to 6 weeks after hospital discharge. Successful treatment of ongoing pain should include screening for depressive symptoms and initiation of appropriate treatment. **Trial Registraton:** Clinicaltrials.gov Identifier: NCT00522717. **Key words:** cardiac surgery, depressive symptoms, pain.

BDI = Beck Depression Inventory; **BMI** = body mass index; **BPI** = Brief Pain Inventory; **BPI-INT** = Brief Pain Inventory–Interference; **BPI-SEV** = Brief Pain Inventory–Severity; **PSQI =** Pittsburgh Sleep Quality Index.

INTRODUCTION

After cardiac surgery, many patients experience depression and its symptoms (1,2). Cardiac surgery patients with depressive symptoms experience more readmissions and hospitalizations, lower quality of life, increased mortality, and higher pain scores compared with those without depressive symptoms (3–5). Unlike the effects of depressive symptoms on recovery, the effects of pain after cardiac surgery are less well known. Reports of the prevalence of persistent or chronic pain after cardiac surgery vary from 21% to 55% (6,7). An estimated 30% to 50% of patients undergoing coronary artery bypass grafting experience persistent postoperative pain (8–10). Studies of comorbid pain and depressive symptoms in primary care and psychiatric settings report a reciprocal relationship between pain and depressive symptoms, in that prevalence rates of each condition are higher when the other is also present (11). For example, 65% of patients undergoing cardiac surgery with depression experience pain, and depression is present in up to 85% of these patients with pain conditions (12).

In general surgical populations, postoperative pain has been associated with psychological distress (7), but this relationship has not been consistent. For example, in spinal surgery patients, a reduction in pain intensity was associated with a reduction in depressive symptoms at 6 months postoperatively, but not at 3 months (13); after breast cancer treatment, women with chronic pain were not more likely to be depressed than women without pain (14). In this broader context, few investigators have reported on the phenomenon of comorbid pain and depressive symptoms in patients after cardiac surgery. Despite compelling evidence that both depressive symptoms and pain are both prevalent after cardiac surgery, only one study to date has investigated post–cardiac surgery comorbid pain and depressive symptoms (15). Investigators found that after hospital discharge, 67% of depressed patients after coronary bypass also had at least moderate pain. Furthermore, depressed patients with at least moderate pain were less likely to respond to depression treatment (15). These findings have not been confirmed by repeated study.

The present study examined the prevalence of depressive and pain symptoms in patients undergoing cardiac surgery from hospital discharge (baseline) to 6-week follow-up. We then tested whether changes in depressive symptoms were associated with changes in pain symptoms from baseline to 6-week follow-up.

METHODS

Sample and Setting

This is a secondary analysis from a randomized controlled trial of cognitive behavioral therapy for depression in patients after cardiac surgery (coronary artery bypass grafting or valve replacement/repair) from July 2006 through October 2009. Institutional review board approvals were obtained from five tertiary care centers in the Greater Los Angeles area from which patients undergoing cardiac surgery were recruited. Exclusion criteria for the parent study were as follows: age less than 30 years, residing outside the greater Los Angeles area, presence of cognitive impairment (Mini-Mental State Exam score <24) or major comorbid psychiatric condition (schizophrenia, bipolar disorder, substance abuse), and autoimmune disorder or malignancy. Of the 490 participants who completed questionnaires at hospital discharge, 251 also completed mailed 6-week follow-up questionnaires and are the subject of this report. There were no differences in age, sex, Charlson comorbidity score, or time from surgery to baseline data collection between those who did and did not complete follow-up questionnaires. Those who were married or partnered tended to be more likely to complete questionnaires at both time points ($p = .06$).

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Procedures

Patients were approached after surgery and before hospital discharge; no preoperative symptom questionnaires were collected. After consent, a brief in-hospital screening interview was conducted to assess cognitive function. Individuals with a score of 24 or higher on the Mini-Mental State Exam (16) completed a brief questionnaire booklet to obtain baseline measures of sociodemographic (marital and work status) and psychobehavioral characteristics (depressive and anxiety symptoms, perceived control, and pain), which was completed before hospital discharge. Medical records were reviewed to obtain demographic data and to identify comorbidities (Charlson Comorbidity Index (17)), preexisting psychiatric conditions, and current medications. Patients with preoperative depression and those on antidepressants were included in the study. Six weeks after hospital discharge, a second questionnaire booklet was mailed to patients along with a self-addressed stamped envelope. Patients with Beck Depression Inventory (BDI) scores of 10 or higher at both predischarge and postdischarge evaluations were considered to have persistent depressive symptoms. For this report, all data were collected before randomization in the parent study.

Instruments

Depressive symptoms were measured with the BDI, a 21-item self-report measure used widely in cardiac patients (18,19). Applied in more than 2000 empirical studies, the BDI has sound internal consistency (i.e., mean Cronbach α = .82) and concurrent validity (i.e., with the Hamilton Rating Scale for Depression [r = 0.75] for non-psychiatric populations) (20). In the current study, internal consistency of the BDI at baseline yielded an α coefficient of .87. Persistent depressive symptoms were defined as BDI scores of 10 or higher, indicating the presence of more than minimal depressive symptoms (19,21).

Pain was measured with the Brief Pain Inventory (BPI) short form, a well-established nine-item questionnaire that assesses a person's current pain state (BPI-SEV) and the degree to which pain interferes in daily living (BPI-INT) (22). The BPI consists of both dichotomous response, open-ended, and Likert scale (0-10) questions, in which 0 equals "no pain" or "no interference" and 10 equals "pain as bad as you can imagine" and "complete interference." In patients undergoing cardiac surgery, the BPI has demonstrated acceptable internal consistency (Cronbach α from .84 to .94) (23). In this study, Cronbach α for the pain interference (BPI-INT) and severity (BPI-SEV) scores was .93 and .86, respectively.

Anxiety, known to be highly comorbid with depressive symptoms (24), was also assessed by the Brief Symptom Inventory anxiety subscale, a six-item questionnaire that measures psychological state anxiety symptoms. Each item is rated on a 5-point scale, with higher scores indicative of higher anxiety. The Brief Symptom Inventory has been used in related cardiac populations (25) and has demonstrated strong internal consistency (Cronbach α = .87) and criterion validity with the Spielberger Anxiety Index (r = 0.70) (26). Cronbach α in this study was .87.

Perceived control over one's health was included because it is known to be inversely correlated with negative affective symptoms and because it is an indicator of cardiac patients' ability to engage in monitoring and management of their cardiac health. Perceived control was measured by the Control Attitudes Scale–Revised, an eight-item questionnaire designed to measure a person's attitude regarding control of his/her cardiac condition. Questions are asked using a 5-point Likert scale, with higher scores indicating a higher degree of distress (27). The Control Attitudes Scale–Revised has established internal consistency, with Cronbach α coefficients of .72, .76, and .73 for coronary heart disease, acute myocardial infarction, and heart failure patients, respectively (27). Cronbach α in this study was .73.

Perceived social support was measured because it has been associated with chronic pain in other surgical populations (28). Perceived social support was assessed using the Multidimensional Scale of Perceived Social Support (29). The Multidimensional Scale of Perceived Social Support assesses perceived social support adequacy from family, friends, or significant others. It consists of 12 items rated on a 7-point Likert scale. Each item is rated from 1 (very strongly disagree) to 7 (very strongly agree). The total score is the sum of the 12 items and ranges from 12 to 84. Higher scores indicate a higher level of perceived social support. Construct validity and reliability have been reported. Cronbach α coefficients previously ranged from .85 to .90 (29). Cronbach α in this study was .95.

Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI). It is a 19-item self-rated questionnaire in which individuals are asked to consider seven subcomponents of their sleep over the last month (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction). Scores are derived by summing the subcomponents and range from 0 to 21, with higher scores indicative of poorer sleep quality (30). The total summary score was used to measure overall sleep quality. Cronbach α in this study was .85.

ANALYSIS

All data analyses were conducted with IBM SPSS 21 (IBM, Somers, NY, 2010). Baseline characteristics between patients with and without persistent depressive symptoms were compared using χ^2 tests and Student t test. The trajectory of depressive symptoms was evaluated from two perspectives. First, changes in depressive symptom scores were described in four groups (low [BDI scores <10 at both baseline and 6-week follow-up], worsening [BDI scores <10 baseline, but BDI scores ≥10 at 6-week follow-up], improving (BDI scores ≥10 at baseline, but BDI scores <10 at 6 weeks], and high [BDI scores ≥10 at both baseline and 6 weeks]). Then, frequencies for persistent depressive symptoms (defined as BDI scores ≥10 at both baseline and 6-week follow-up) and persistent pain (defined as BPI-INT or BPI-SEV scores ≥1 at both time points) were calculated. For persistent depressive symptoms, the cut-point of BDI scores of 10 or higher was based on the recommendation for the presence of greater than minimal symptoms (19). For persistent pain, the cut-point of BPI-INT and BPI-SEV scores of 1 or higher was selected because it represented the presence of any pain and had been used in previous studies (7).

The contribution of persistent depressive symptoms on 6-week measures of BPI-INT and BPI-SEV was evaluated using repeated-measures analysis of variance with stratification of the sample by persistent depressive symptoms or not, controlling for age and baseline pain symptoms. Two linear regressions were performed to quantify the relation between BPI-INT and BPI-SEV scores and changes in depressive symptom scores from baseline to 6-week follow-up. Simple forced entry was used, with variables entered in two blocks. Clinical variables, baseline BPI-INT or BPI-SEV scores, and baseline variables of related psychobehavioral variables (anxiety, sleep quality, perceived control, and perceived social support) were entered into the first block, with depressive symptom change scores (6-week follow-up minus baseline) entered into the second block. Given the possibility of shared variance related to insomnia in the BDI and PSQI, we entered the PSQI in the first block to remove the influence of any overlapping variance. As a further check, we ran the regressions with and without the PSQI. Because results were similar, we present the analyses with the PSQI in the models. Significance was set at $p < .05$ for all analyses.

RESULTS

A total of 251 patients undergoing cardiac surgery completed the questionnaires at discharge and 6 weeks later (Table 1). The sample was predominately white (72%), male (73%), older (mean

TABLE 1. Characteristics of Patients With and Without Persistent Depressive Symptoms

Characteristics	Persistent Depressive Symptoms (BDI scores ≥10; *n* = 41), *n* (%) or M (SD)	No Persistent Depressive Symptoms (BDI scores <10; *n* = 210), *n* (%) or M (SD)	p^a
Demographics			
Age, y	63.5 (7.9)	68.1 (9.7)	.005
Female	11 (26.8)	57 (27.1)	.97
Non-Hispanic White	27 (65.9)	153 (72.9)	.36
>High school education	33 (80.5)	158 (76.3)	.56
Married or cohabitating	28 (68.3)	150 (71.4)	.69
Employed	15 (38.5)	84 (40.0)	.86
Biomedical measures			
Body mass index, kg/m^2	28.9 (7.3)	28.8 (5.6)	.88
Charlson Comorbidity Index total score	3.3 (1.6)	3.7 (1.8)	.28
Nonelective surgery	14 (36.8)	76 (38.2)	.88
Type of surgery, CABG	25 (71.4)	85 (54.5)	.14
Postoperative complications (yes)	14 (40.0)	76 (45.8)	.53
Number of grafts	2.6 (1.2)	2.2 (1.2)	.11
Pump time, min	80.8 (33.3)	96.7 (44.6)	.033
Cross-clamp time, min	55.5 (26.1)	72.0 (37.9)	.011
Ejection fraction	52.0 (17.3)	53.6 (12.8)	.53
Time from surgery to enrollment, d	9.5 (13.7)	9.2 (11.9)	.90
Psychosocial measures			
Mini-Mental Exam total score	27.4 (1.0)	27.6 (0.8)	.15
Baseline anxiety	1.3 (1.1)	0.7 (0.7)	<.001
Baseline pain interference	5.0 (3.5)	3.3 (2.6)	<.001
Baseline pain severity	3.9 (2.4)	3.1 (2.0)	.028
Baseline perceived control	27.2 (6.3)	31.4 (7.0)	.001
Baseline perceived social support	70.8 (11.0)	73.3 (12.9)	.24
Baseline sleep quality	10.7 (4.2)	7.0 (4.0)	<.001
Depression-related measures			
History of depression	9 (22.0)	17 (8.1)	.008
On antidepressants	5 (12.2)	19 (9.0)	.53
Baseline depressive symptoms	15.7 (6.6)	5.7 (4.1)	<.001

CABG = coronary artery bypass grafting; BDI = Beck Depression Inventory; M = mean; SD = standard deviation.
[a] Using *t* tests or χ^2 tests.

[SD] age = 67.3 [9.5] years), and married (71%) and did not have a history of depression (90%).

In the sample as a whole, mean depressive symptom scores did not change from baseline to 6-week follow-up (Table 2). At baseline, depressive symptoms were significantly correlated with both BPI-INT and BPI-SEV. Similarly, changes in depressives at 6 weeks were also significantly correlated with changes in BPI-INT and BPI-SEV (Table 3).

Forty-one (16.3%) patients reported persistent depressive symptoms (i.e., BDI score ≥10 at both time points). In 25 (10%) and 34 (13.5%) patients, BDI scores worsened or improved, respectively, from baseline to 6 weeks. The remaining 151 (60.2%) had BDI scores lower than 10 at both time points (Fig. 1). Compared with patients without persistent depressive symptoms (*n* = 210; 83.7%), patients with persistent depressive symptoms were younger, were more likely to have a history of depression,

TABLE 2. Change in Depressive and Pain Symptoms from Hospital Discharge (Baseline) to 6-Week Follow-Up (*n* = 251)

	Hospital Discharge (Baseline), M (SD)	6-wk Follow-Up, M (SD)	Change Score (Follow-Up Minus Baseline), M (SD)	p^a
Beck Depression Inventory	7.33 (5.93)	7.49 (7.66)	0.15 (7.16)	.75
Brief Pain Inventory: Pain Interference	3.54 (2.84)	2.10 (2.35)	−1.44 (2.87)	<.001
Brief Pain Inventory: Pain Severity	3.26 (2.10)	2.32 (1.92)	−0.94 (2.11)	<.001

M = mean; SD = standard deviation.
[a] Using *t* tests

TABLE 3. Correlations of Baseline and Change Scores (Follow-Up Minus Baseline) Among Depressive Symptoms, Pain Interference, and Pain Severity ($n = 251$)

	Baseline		Change Score (Follow-up Minus Baseline)	
	Brief Pain Inventory Interference	Brief Pain Inventory Severity	Brief Pain Inventory Interference	Brief Pain Inventory Severity
Baseline				
Beck Depression Inventory Total	.37*	.29*	−.07	−.10
Beck Depression Inventory Cognitive/Affective Symptoms	.29*	.24*	−.06	−.06
Beck Depression Inventory Somatic Symptoms	.33*	.23*	−.12	−.12
Change score (follow-up minus baseline)				
Beck Depression Inventory Total	−.02	−.002	.35*	.22*
Beck Depression Inventory Cognitive/Affective Symptoms	−.01	−.01	.33*	.18*
Beck Depression Inventory Somatic Symptoms	−.03	.01	.28*	.20*

* $p = .01$, two-tailed.

and had higher pain symptoms, higher anxiety scores, greater disturbance of sleep quality, and lower perceived control scores at baseline (hospital discharge). There were no significant differences in race/ethnicity, educational level, marital or employment status, or other demographic variables between the groups.

The most commonly reported locations of pain at baseline and 6 weeks were chest/sternum (baseline: 39.8%; 6 weeks: 40.2%), back (baseline: 17.1%; 6 weeks: 12.7%), and legs/knees (baseline: 12%; 6 weeks: 12.7%). Both pain interference and pain severity scores decreased over time (Table 2). Persistent pain interference (BPI-INT scores ≥1 at both time points) and persistent pain severity (BPI-SEV scores ≥1 at both time points) were common, ranging from 47.8% to 67.7% (Fig. 2). Compared with patients without persistent pain interference, those with persistent pain interference were younger (69.3 [8.7] versus 65.2 [9.9] years, respectively; $p = .002$) and had fewer comorbid medical conditions (3.9 [1.7] versus 3.3 [1.9], respectively; $p = .02$). No demographic differences were found between those with and without persistent pain severity.

Patients with persistent depressive symptoms had higher BPI-INT and BPI-SEV scores at 6 weeks compared with patients without persistent depressive symptoms. In repeated-measures analysis of variance analysis, the group × time interaction remained significant in both the pain interference model (BPI-INT: $F = 17.5$, $p < .001$) and the pain severity model (BPI-SEV: $F = 9.06$, $p = .003$), after controlling for age and baseline pain scores (Fig. 3). In linear regression modeling, after controlling for other psychobehavioral variables (anxiety, perceived control, social support, global sleep quality), none of which were significant, changes in depressive symptoms were independently associated with higher BPI-INT ($p < .001$) and BPI-SEV ($p = .001$; Tables 4 and 5). Alone, changes in depressive symptoms explained 17% of the variance in BPI-INT, but only 4% of the variance in BPI-SEV scores. When the cognitive/affective and somatic subscales of the BDI were considered separately in linear regression modeling, similar findings were observed.

DISCUSSION

Patterns of Depressive Symptoms

In the sample as a whole, depressive symptoms did not change from discharge to 6-week follow-up. Although depressive symptoms have been reported to be highly prevalent

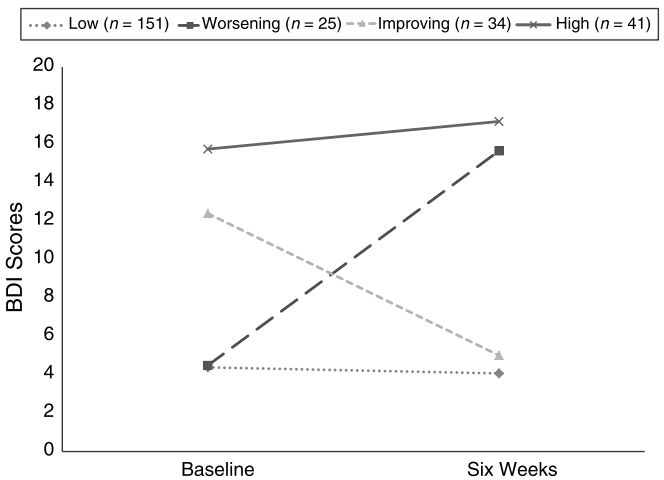

Figure 1. Patterns of change in depressive symptoms between baseline and 6 weeks. BDI = Beck Depression Inventory.

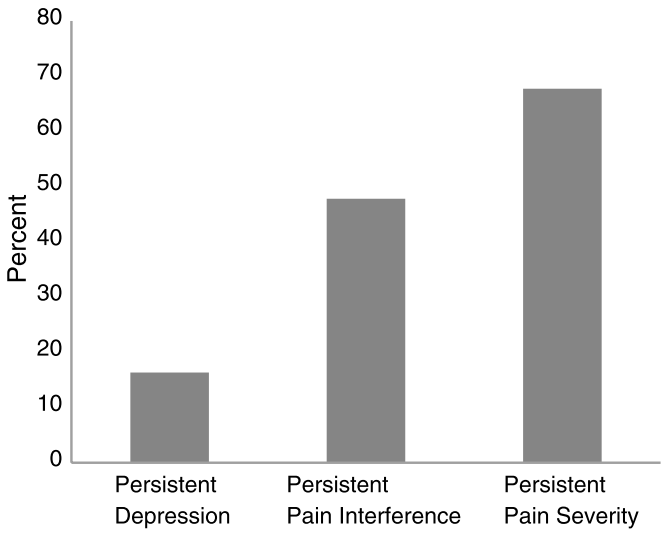

Figure 2. Percentages of persistent depression and persistent pain.

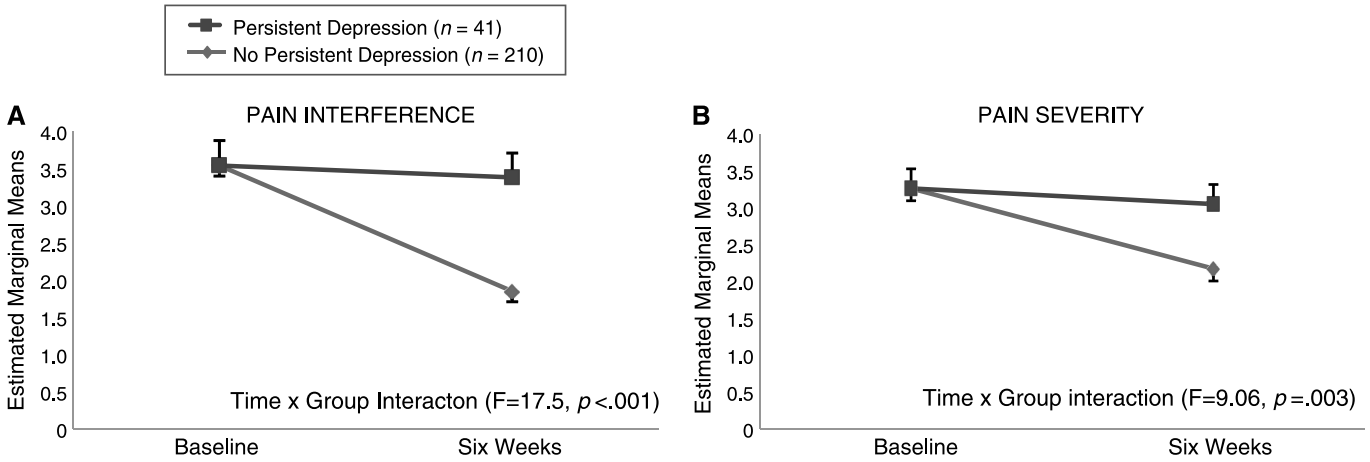

Figure 3. Effect of persistent depression on pain interference and pain severity. Controlling for age and baseline pain interference (top panel) or pain severity (bottom panel); standard errors shown.

generally after cardiac surgery (2,31), approximately 60% of our sample had low symptoms both at hospital discharge and at 6-week follow-up. An additional 10% had at least moderate symptoms at hospital discharge, but those symptoms had abated 6 weeks later. These findings are consistent with recent reports in which depression or its symptoms were reported to be more prevalent at the time of hospital discharge (21%–24%) (5,32,33) than a month to 12 weeks later (13%–16%) (34,35). Morone et al. (15) found significantly higher rates of depression (up to 60%) 2 weeks after hospital discharge. However, our findings and those of other investigators (34–36) suggest that depressive symptoms may continue to evolve after the first two postdischarge weeks. Therefore, it seems likely that in some patients, the presence of early postoperative depressive symptoms may be a reactive or adjustment response to surgery and hospitalization.

In approximately 30% of patients, depressive symptoms either remained above minimal levels or worsened after hospital discharge. These finding are consistent with other reports (37,38). Patients with persistent depressive symptoms (from discharge to 6 weeks) were more likely to have a history of depression (Table 1). This finding supports the role of depression history as an important clinical risk factor for depressive symptoms in this population (39). Regarding worsening symptoms, some patients may experience a "honeymoon" period in the hospital and only experience depressive symptoms after they return home, which underscores the need for continued assessment of depressive symptoms in the postdischarge period after cardiac surgery.

TABLE 4. Determinants of Pain Interference 6 Weeks After Hospital Discharge[a]

Model	R^2	Adjusted R^2	R^2 Change	*F* Change	*F* Change Significance
Step 1	0.22	0.17	0.22	4.39	<.001
Step 2	0.38	0.35	0.17	46.62	<.001

Variables in the Equation at Step 2	Standardized β	*t*	Significance	95.0% Confidence Interval for β	
				Lower	Upper
(Constant)		1.91	.058	−0.12	6.84
Age in years	−0.15	−2.31	.022	−0.07	−0.01
Body mass index	0.01	0.15	.88	−0.05	0.05
Pump time, min	0.04	0.20	.84	−0.02	0.02
Cross-clamp time, min	−0.06	−0.34	.73	−0.03	0.02
Baseline pain interference	0.27	4.19	<.001	−.12	0.34
Marital status (single/partnered)	0.04	0.63	.53	−0.44	0.85
Baseline perceived control	0.005	0.08	.94	−0.04	0.05
Baseline global sleep quality	0.12	1.80	.074	−0.01	0.14
Baseline anxiety	0.15	2.20	.026	0.05	0.83
Baseline social support	−0.05	−0.76	.45	−0.04	0.02
Time from surgery to enrollment	0.04	0.56	.58	−0.02	0.03
Change in depressive symptoms	0.42	6.82	<.001	0.09	0.17

[a] Linear regression, pain interference as a dependent variable in analysis.

TABLE 5. Determinants of Pain Severity 6 Weeks After Hospital Discharge[a]

Model	R^2	Adjusted R^2	R^2 Change	F Change	F Change Significance
Step 1	0.26	0.22	0.26	5.64	<.001
Step 2	0.31	0.26	0.04	10.60	.001

				95.0% Confidence Interval for β	
Variables in the Equation at Step 2	Standardized β	t	Significance	Lower	Upper
(Constant)		1.61	.11	−0.55	5.35
Age in years	−0.12	−1.71	.090	−0.05	0.004
Body mass index	−0.01	−0.21	.84	−0.05	0.04
Pump time (minutes)	0.07	0.35	.73	−0.01	0.02
Cross-clamp time, min	−0.08	−0.41	.68	−0.02	0.02
Baseline pain severity	0.40	5.62	<.001	0.24	0.50
Marital status (single/partnered)	0.12	1.78	.077	−0.05	1.05
Baseline perceived control	−0.05	−0.61	.54	−0.05	0.03
Baseline global sleep quality	0.05	0.72	.47	−0.04	0.09
Baseline anxiety	0.09	1.26	.21	−0.12	0.54
Baseline social support	0.001	0.01	.99	−0.02	0.02
Time from surgery to enrollment	0.06	0.88	.38	−0.01	0.03
Change in depressive symptoms	0.21	3.26	.001	0.02	0.09

[a] Linear regression, pain severity as a dependent variable in analysis.

Contribution of Depressive Symptoms to Pain Symptoms

From discharge to 6 weeks, patients undergoing cardiac surgery with persistent depressive symptoms sustained higher levels of pain interference and pain severity. In addition, clinical and demographic variables were not related to either later pain interference or pain severity in multivariate analysis (Tables 4–5). In these analyses, only baseline pain measures and changes in depressive symptoms were associated with 6-week pain measures when demographic, clinical, and baseline psychobehavioral variables were considered. Pain interference was more strongly related to changes in depressive symptoms than was pain severity. This finding may be explained by cognitive theory in that a negative bias in depressed individuals, that is, "depressogenic" thoughts and assumptions, may be associated with a more negative interpretation of pain (40). Baseline sleep quality did not contribute significantly to later pain interference or pain severity. Some studies have reported a direct relationship between sleep and pain, regardless of the effects of depressive symptoms (41,42). Of note, in patients both with and without persistent depressive symptoms, sleep quality was poor; mean scores in both groups were above the level normally considered to indicate the presence of sleep impairment (30). Thus, the absence of a relationship between sleep quality and pain may be due to the relative absence of variability in sleep impairment. Other studies found a direct relationship between depressive symptoms and pain (43), as we did. Overall, it is likely that there are multidirectional linkages among symptoms of pain, depression, and sleep disturbance, which suggest common neurobiologic substrates (44).

In a few previous reports of postoperative thoracotomy pain, other investigators have also shown that early postoperative pain is predictive of later chronic pain (45). In another postthoracotomy sample, Ochroch et al. (46) reported greater postoperative pain in women after major thoracotomy, although we found no differences in pain severity or interference between men and women. In two reports of patients undergoing coronary artery bypass grafting, investigators found that depressive symptoms early after hospital discharge were associated with greater pain 1 year later (15) and that depressive symptoms and chronic pain correlated when both were measured more than 2 years after surgery (47).

A difficulty in synthesizing these data is that studies have measured depressive and pain symptoms with a wide variety of instruments and at many different time points after cardiac surgery. Nonetheless, our findings indicate that the association of persistent depressive symptoms and persistent pain begins much earlier after surgery than previously believed. An important consideration in understanding the relationship between persistent pain and depressive symptoms after cardiac surgery is its complexity. Current evidence suggests that this relationship is bidirectional (11,44). Multiple factors are likely to influence the relationship of persistent pain and depressive symptoms. Researchers hypothesize that shared neurobiology, genetics, and environmental factors play a role (48). Cognitive processes (i.e., negative thinking) and behavioral factors (i.e., poor sleep hygiene) are associated with both pain and depressive symptoms (11,48). Psychosocial conditions such as perceived control and social support are likely to influence the severity of both pain and depressive symptoms (48). With that in mind, further study is needed to elucidate how these factors interact with pain and depressive symptoms to influence their severity and chronicity.

Our study has several limitations. All of our patients resided in a single metropolitan area and were recruited from urban medical centers, so our findings may not be generalizable to other settings. We enrolled patients after surgery, so no preoperative questionnaires were obtained. We included patients having several types of cardiac surgery, so their pain experiences may have differed. We measured depressive symptoms using a well-established symptom instrument, so we cannot make inferences regarding clinical depression. In addition, the potential circularity of pain-depression relationships, presence of other unmeasured contributors to pain, and possible active treatments occurring between baseline and 6-week measurements may limit the interpretation of our data.

Despite these limitations, our findings have implications for clinical practice. First, depressive symptoms follow different, identifiable patterns after cardiac surgery. Although many individuals may not have troublesome depressive symptoms after surgery or in the first months after hospital discharge, some patients will have either persistent depressive symptoms or increasing depressive symptoms after discharge. Thus, more routine depression screening, as recommended by the American Heart Association (49), could be beneficial. Second, in most patients, persistent pain symptoms continue up to 6 weeks after cardiac surgery. Clinicians may find it helpful to evaluate both pain and depressive symptoms over time, appreciating that their complex relationship contributes to delayed recovery. Successful treatment of postoperative pain, which is an important goal in all clinical guidelines, may be enhanced with screening for depressive symptoms and initiation of treatment, if appropriate.

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