Social Support, Depression, and Mortality During the First Year After Myocardial Infarction

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Background—We previously reported that depression after myocardial infarction (MI) increases the long-term risk of cardiac mortality. Other research suggests that social support may also influence prognosis. This article examines the interrelationships between baseline depression and social support in terms of cardiac prognosis and changes in depression symptoms over the first post-MI year.

Methods and Results—For this study, 887 patients completed the Beck Depression Inventory (BDI) and the Perceived Social Support Scale (PSSS) at about 7 days after MI. Some 32% had BDI scores ≥10, indicating mild to moderate depression. One-year survival status was determined for all patients. Follow-up interviews, including the BDI, were conducted with 89% of survivors. There were 39 deaths (35 cardiac). Elevated BDI scores were related to cardiac mortality (P=0.0006), but PSSS scores and other measures of social support were not. There was a significant interaction between depression and the PSSS (P=0.016). The relationship between depression and cardiac mortality decreased with increasing support. Furthermore, residual change score analysis revealed that among 1-year survivors who had been depressed at baseline, higher baseline social support was related to more improvement in depression symptoms than expected.

Conclusions—Post-MI depression is a predictor of 1-year cardiac mortality, but social support is not directly related to survival. However, very high levels of support appear to buffer the impact of depression on mortality. Furthermore, high levels of support predict improvements in depression symptoms over the first post-MI year in depressed patients. High levels of support may protect patients from the negative prognostic consequences of depression because of improvements in depression symptoms. (Circulation. 2000;101:1919-1924.)

Key Words: myocardial infarction ■ depression ■ social support ■ prognosis

Research has demonstrated that depression is related to poor prognosis in patients with established coronary artery disease (CAD), particularly in those recovering from myocardial infarction (MI).1 For example, we previously reported that depression is associated with a 3- to 4-fold increase in cardiac mortality over the first 18 months after an MI.2,3 Although secondary analysis of these data suggested that measures of social support have no direct relationship to prognosis after MI,4 other research has indicated that socially isolated patients or those who report low social support may also be at increased risk.5–7 However, the extent to which depression and social support have interrelated prognostic impacts in post-MI patients is unclear.

There is consistent evidence in a variety of settings that levels of depression symptoms correlate negatively with measures of social support and that depressed patients, including those with and without cardiac disease, report lower social support than nondepressed individuals.8–11 Furthermore, some longitudinal community surveys and studies of psychiatric patients also suggest that depressed patients with good support may experience more rapid symptom improvement and may be less likely to experience recurrences of depression.10,12–14 One recent report indicates that perceived social support during hospitalization for cardiac catheterization predicts changes in depression symptoms over the subsequent month.15 All this research suggests that the impact of depression on post-MI prognosis might vary, depending on the level of social support. However, this question has not been explored, and the sample size of our previous study was too small (n=222) to reliably examine these interrelationships. Therefore, the purpose of this article is to explore the relationships between depression and social support in terms of both cardiac prognosis and changes in depression symptoms over the first post-MI year.
Methods

Sample

The sample involves 887 patients who completed the BDI\(^{16}\) and PSSS\(^{17}\) during hospitalization for an acute MI. They were recruited in 2 separate projects: the Montreal Heart Attack Readjustment Trial (M-HART)\(^{18}\) and the Emotions and Prognosis Post-Infarct (EPPI) Study.\(^{2,3}\) M-HART was a randomized, controlled trial of psychosocial intervention for post-MI patients. The present study combines participants in the control group from that trial with those in the EPPI study, a prospective examination of psychosocial risk after MI. The procedures and data collection methods for the 2 studies were similar. Because methodological details have been provided in previous publications, only the major outlines will be given here.

Subjects were recruited from consecutive admissions for an acute non–procedure-related MI in 10 Montreal area hospitals between 1991 and 1994. Exclusion criteria included other life-threatening conditions; inability to speak English or French; cognitive impairment or physical inability to complete the in-hospital interview; living too far to return to the hospital for follow-ups; and physician refusal, participation in other research, or early discharge. Some 63.6% of 2512 patients meeting selection requirements agreed to take part. This included 222 patients in the EPPI study and 684 in the M-HART control group (the 692 in the treatment group are not included in the present report). Of these 906 individuals, 887 completed baseline measures of depression and social support and constitute the current sample. Patients ranged from 24 to 88 years of age (mean ± SD, 59.3 ± 11.2 years). For 76.3%, the index MI was their first infarct. There were 279 women (31.5%).

Procedures

Structured baseline interviews were conducted by trained research assistants soon after patients were transferred from intensive care to medical wards. The 21-item self-report BDI was used to assess symptoms of depression. BDI scores ≥ 10 are considered to indicate at least mild to moderate levels of depression symptoms.\(^{19}\) In the remainder of this report, we refer to these patients as “depressed.” Patients also responded to the PSSS, a 12-item self-report scale that assesses perceived availability and satisfaction with support received from family, friends, and a “special person.” Five other measures of social support were obtained: whether patients felt they had any close friends or any close relatives, the total number of friends and relatives whom patients considered close and saw or talked to on a monthly basis, and 2 demographic indicators often used as proxy measures of support, marital status and whether patients were living alone. Close friends and relatives were defined as “people you feel at ease with, can talk to about private matters, or can call on for help.” A variety of demographic and medical history variables, including sex, age, education, smoking at the time of the MI, previous treatment for hypertension, and previous MI, were also assessed. Data obtained from hospital charts included Killip class,\(^{20}\) left ventricular ejection fraction (n = 868), treatment with a thrombolytic at admission, prescription of hypoglycemic medications or insulin at discharge, and revascularization (coronary angioplasty or bypass) before or during the index admission.

One-year follow-up interviews, including the BDI, were conducted at home with 758 of the surviving patients (89.4%). Those who were not available for follow-up interviews differed significantly from others on only 2 baseline variables. Noncompleters were more likely to be women (P = 0.051) and had lower PSSS scores (P = 0.002).

Survival status was obtained for all patients at 365 days after discharge. Initial data were obtained from interviews with patients or family members and from Quebec Medicare data. Additional information about causes and dates of death came from hospital charts and autopsy reports (when available). Causes of death were independently classified as cardiac and noncardiac by 2 cardiologists who were blinded to baseline data and, in the case of the M-HART study, to treatment group.

Data Analysis

Data were analyzed with SPSS for Windows (version 9.0).\(^{21}\) Statistical tests were 2 sided. P ≤ 0.05 were considered statistically significant, with P ≤ 0.10 and P ≥ 0.05 classified as marginal. The importance of baseline measures of social support, as well as their interactions with baseline depression, in predicting 1-year cardiac mortality was assessed by use of logistic regression procedures. One difficulty in measuring change is that extreme scorers are likely to show more change when assessed a second time than people with more moderate initial scores (regression to the mean). To adjust for this problem, we used residual change score analysis to assess changes in BDI scores between baseline and 1 year in survivors.\(^{22,23}\) Multiple linear regression analysis was used first to predict a follow-up score for each subject on the basis of his or her initial BDI score and the degree of change in the sample as a whole. The difference between this predicted score and the actual follow-up BDI score for each subject constituted the residual change score. These scores indicate whether the observed degree of change for a particular subject was greater or less than the change predicted linearly by his or her baseline score. A positive residual change score means that a patient had fewer depression symptoms at 1 year than expected. A negative score means that a patient had more depression symptoms than expected. The relationships between baseline measures of social support and residual BDI change scores were examined with ANOVA and multiple linear regression procedures. These analyses also assessed the main effects of baseline depression and the interaction between depression and each baseline variable.

Results

Baseline Psychosocial Measures

Table 1 shows the degree of intercorrelation among the baseline measures of social support and Beck Depression

### Table 1. Intercorrelations Among Psychosocial Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Number of Close Close Close Married Living With Baseline Friends and Relatives in Regular Contact</th>
<th>≥1 Friend</th>
<th>≥1 Relative</th>
<th>Other(s)</th>
<th>BDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSSS</td>
<td>0.24†</td>
<td>0.33†</td>
<td>0.18†</td>
<td>0.09†</td>
<td>−0.23†</td>
</tr>
<tr>
<td>Number of close friends and relatives in regular contact</td>
<td>0.17†</td>
<td>0.040</td>
<td>−0.045</td>
<td>−0.10†</td>
<td>−0.15†</td>
</tr>
<tr>
<td>≥1 Close friend</td>
<td>0.048*</td>
<td>0.044</td>
<td>−0.006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥1 Close relative</td>
<td>0.77†</td>
<td>−0.13†</td>
<td>−0.09†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>0.77†</td>
<td>−0.13†</td>
<td>−0.09†</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on 871 patients with complete data on all measures. Table includes contingency coefficients for pairs of categoric variables.

\( \ast P<0.05; \dagger P<0.01 \)
TABLE 2. Baseline Comparisons Between the Depressed and Nondepressed on Measures of Social Support

<table>
<thead>
<tr>
<th></th>
<th>Nondepressed (BDI&lt;10; n=603)</th>
<th>Depressed (BDI≥10; n=284)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean PSSS (BDI&lt;10)</td>
<td>71.1</td>
<td>67.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Mean number of close friends and relatives in regular contact (number of patients)</td>
<td>8.3 (592)</td>
<td>7.6 (281)</td>
<td>0.25</td>
</tr>
<tr>
<td>≥1 Close friend, %</td>
<td>80.9</td>
<td>73.9</td>
<td>0.018</td>
</tr>
<tr>
<td>≥1 Close relative, % (n)</td>
<td>87.5 (601)</td>
<td>87.3 (283)</td>
<td>0.92</td>
</tr>
<tr>
<td>Married, %</td>
<td>75.6</td>
<td>64.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Living with others, %</td>
<td>83.3</td>
<td>77.5</td>
<td>0.039</td>
</tr>
</tbody>
</table>

Inventory (BDI) scores. Other than the relationship between marital status and living with others, the measures were not highly interrelated. In fact, the level of correlation between our indexes of support and depressive symptoms suggests that they share at most ~5% of variance and tap largely independent psychosocial constructs.

Some 32.0% of patients had baseline BDI scores ≥10, indicative of at least mild to moderate depression. Comparisons of the depressed (BDI ≥10) and nondepressed patients on measures of social support appear in Table 2. The depressed had significantly lower Perceived Social Support Scale (PSSS) scores, were less likely to report having ≥1 close friend, were less likely to be married, and were less likely to be living with ≥1 others than the nondepressed. However, there were no depression-related differences in reports of having ≥1 close relative or the mean number of close friends and relatives in monthly contact.

Cardiac Mortality at 1 Year

By 1 year, there were 39 deaths (35 cardiac). As reported previously,24 the depressed were at significantly increased risk of 1-year cardiac mortality (OR=3.36; 95% CI=1.68 to 6.70; P=0.0006). Although the depressed differed from the nondepressed in a number of background characteristics (described in detail elsewhere),24 the depression-related difference in cardiac mortality remained significant (P=0.0013) after controlling for multivariate predictors of 1-year cardiac mortality, including age, Killip class, and the interactions between sex and non–Q-wave MI, sex and left ventricular ejection fraction, and sex and smoking.

Although no measure of social support showed any overall relationship with cardiac mortality (all P≥0.45), there was a significant interaction between the continuous PSSS score and baseline depression (P=0.016). None of the other interactions between measures of social support and depression were significant (all P>0.20).

The interaction between depression and the PSSS score, divided into quartiles for illustrative purposes, is shown in Figure 1. At very low levels of perceived social support, the impact of depression on prognosis was quite marked. For patients in the middle ranges of perceived support, the link between depression and survival was still apparent. However, among patients in the highest quartile of perceived social support, there was no depression-related increase in cardiac mortality.

The interaction of depression and perceived social support with 1-year cardiac mortality remained significant (for continuous PSSS, P=0.047) after adjustment for all variables included in the multivariate model derived in our previous research (age, Killip class, and the interactions between sex and non–Q-wave MI, sex and left ventricular ejection fraction, and sex and smoking).

These results suggest some role for perceived social support in predicting and possibly preventing depression-related cardiac mortality. One mechanism by which perceived support could buffer the impact of depression on prognosis is by reducing depression symptoms over time. This issue is the focus of the remaining analyses.

Changes in Symptoms of Depression at 1 Year

Rates of depression remained high at 1 year. Although some 29.8% of the survivors had been depressed in hospital, 26.0% were depressed at 1 year. This included 52.7% of those who had been depressed in hospital and 14.7% of those not originally depressed. On average, patients who had been depressed in hospital experienced a decline of ~5 points in their BDI scores by 1 year, and the nondepressed showed an increase of ~1 point (P<0.0001), reflecting, in part, an expected regression to the mean. Therefore, we assessed relationships between baseline variables and changes in BDI scores by calculating residual change scores.

Results of multiple linear regression analyses showed no overall relationships between baseline measures of social support and residual BDI change scores. However, there were significant interactions between baseline depression and 5 of the 6 measures of social support. Figure 2 shows the significant interactions. In that figure, the PSSS score and the number of close friends and relatives in regular contact are divided into quartiles for illustrative purposes. For each interaction, the x axis (at the 0 point) represents the degree of change that would be expected in the BDI score on the basis...
of the BDI level at baseline. Mean values above the axis indicate that a particular group had fewer depression symptoms at 1 year than predicted, with higher positive means indicating better outcomes. Mean values below the axis show groups with more depression symptoms than predicted, with more negative values indicating worse outcomes. For the PSSS score, we see that among people who were not depressed at baseline, perceived social support was unrelated to changes in depression symptoms. Average residual change scores were all \( \approx 0 \). However, among people who had been depressed at baseline, residual changes in depression symptoms were related to perceived social support. Those with the lowest perceived social support tended to show more depression symptoms than expected (values below the x axis), whereas those with the highest perceived support showed markedly fewer depression symptoms than expected. The patterns for all interactions were similar. In short, social support had an impact on BDI score changes in patients who had been depressed at baseline. There was relatively little evidence of a relationship between social support and changes in depression symptoms in the nondepressed. Average residual change scores were all \( \approx 0 \). However, among people who had been depressed at baseline, residual changes in depression symptoms were related to perceived social support. Those with the lowest perceived social support tended to show more depression symptoms than expected (values below the x axis), whereas those with the highest perceived support showed markedly fewer depression symptoms than expected. The patterns for all interactions were similar. In short, social support had an impact on BDI score changes in patients who had been depressed at baseline. There was relatively little evidence of a relationship between social support and changes in depression symptoms in the nondepressed. Depressed patients who had the least social support (ie, those with lower PSSS scores, those with no relatives whom they perceived as close, those with lower numbers of regular interactions with friends and relatives whom they perceived as close, those who were unmarried, and those who lived alone) tended to experience more symptoms of depression at 1 year than would have been expected on the basis of their baseline BDI scores. In contrast, depressed patients with higher support tended to show fewer depression symptoms than predicted. The only social support measure unrelated to BDI changes was whether patients reported having any close friends.

There was no evidence that demographic factors, including age, sex, and education, or most measures of cardiac risk or history were linked to changes in depression symptoms. Only 2 baseline variables were significantly related to residual BDI change scores, Killip class \( (P=0.002) \) and diabetes \( (P=0.002) \). Regardless of whether or not they had been depressed at baseline, patients with advanced Killip class and those who were diabetic tended to have more depression symptoms at 1 year than expected at baseline. There was also a significant interaction between diabetes and baseline depression \( (P=0.012) \), showing that diabetics who had been depressed in hospital were particularly likely to have more depression symptoms at 1 year than expected on the basis of their baseline BDI scores.

Each of the significant interactions of depression and social support in relation to residual BDI change scores remained at least marginally significant after controlling for these measures of disease severity for PSSS by depression, \( P=0.054 \); for number of close friends and relatives in regular contact by depression, \( P=0.001 \); for any close relatives by depression,
demonstrated in psychiatric and community samples, is also improvements in depression symptoms, which has often been formal treatment. Thus, the impact of social support on suggestion symptoms in depressed post-MI patients even without treatments with other significant people helping to reduce depression, if there is a causal influence, is far from clear. It has been argued that inadequate social support and isolation from others lead to depression, particularly in the face of life crises. There is also evidence that depressed individuals exhaust the resources of their support networks and alienate those around them, leading to less support. Finally, there is what is sometimes called the “plaintive set” or negative lens of depression in which perceptions of social support are distorted, so the depressed individual does not perceive the support that is available.

To examine the relative importance of the different measures of social support in mediating changes in depression symptoms in patients who had been depressed at baseline, we restricted analyses to this group and carried out stepwise multiple regression analyses to predict residual changes in BDI scores. With forward stepping, the PSSS score entered on the first step, followed by the number of close friends and relatives in contact. Whether the patient lived alone entered on the third step (see Table 3). The same variables were selected by backward stepping. Thus, there is evidence that perceptions of social support, reported frequency of social interaction, and a demographic proxy variable for social support (whether patients lived with others) have independent impacts on 1-year changes in depression symptoms in post-MI patients who are depressed during hospitalization.

**Discussion**

Although there is increasing evidence that depression has an impact on survival in patients with various manifestations of CAD and there have been studies linking social support with prognosis, to the best of our knowledge, this is the first study we refer to examine the impact of the 2 variables in combination after MI. We observed that as previously reported, depressed patients were at significantly increased risk of post-MI mortality. However, this was not true for those who perceived very high levels of social support. Not only were depressed individuals with high support at baseline not at increased risk of cardiac mortality, but also their depression symptoms were more likely to improve than those of the depressed with low to moderate support. Furthermore, we found that 3 different measures of social support had independent relationships with improvements in depression: higher scores on a measure of perceived social support, a greater number of close friends and relatives with whom the patient had regular monthly contact on phone or person, and living with $\geq 1$ person. It appears that good support can constitute a sort of “psychotherapy of everyday life,” with multiple aspects of interaction with other significant people helping to reduce depression symptoms in depressed post-MI patients even without formal treatment. Thus, the impact of social support on improvements in depression symptoms, which has often been demonstrated in psychiatric and community samples, is also present in patients recovering from MI. However, like other researchers working with patients with CAD, we found that overall rates of depression at 1 year remained high, indicating a need for appropriate intervention strategies beyond naturally occurring support for many patients.

We also found, as have others studying noncardiac groups, that depressed patients perceived less social support, were less likely to have close friends, were more likely to be unmarried, and were more likely to be living alone than nondepressed patients, but we also found that depressed and nondepressed patients did not differ in their reported frequency of monthly contacts with friends and relatives. However, the direction of causality between social support and depression, if there is a causal influence, is far from clear.
depressed patients have very positive perceptions of support availability, have large social networks with whom they are in regular contact, or are living with others. In comparison, the combination of depression and poor social support is associated with a substantial increase in risk of mortality over at least the first post-MI year, as well as with continuing chronic depression in survivors. Clinicians should be alert to the potential consequences of this combination and consider expanding their assessment of post-MI depression to include a few simple questions like those used in our research to find out about the patient’s views of the availability and adequacy of support and help from friends and family members.

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