CARDIOVASCULAR MEDICINE

Rapid screening for major depression in post-myocardial infarction patients: an investigation using Beck Depression Inventory II items

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Objective: To determine the ability of three questions from the Beck Depression Inventory II (BDI-II) to detect major depressive disorder (MDD) in a cohort of patients hospitalised for acute myocardial infarction (MI).
Design: Prospective observational study.
Setting: Coronary care unit and cardiac step-down unit of an urban academic medical centre.
Patients: 131 post-MI patients within 72 h of symptom onset.
Interventions: Patients were administered the BDI-II and participated in a structured diagnostic interview for MDD. Three individual BDI-II items (regarding sadness, loss of interest and loss of pleasure) were examined individually and in two-question combinations to determine their ability to screen for MDD.
Main outcome measures: Sensitivity, specificity, negative and positive predictive values and proportion of patients with MDD correctly identified.
Results: The individual items and two-question combinations had good sensitivity (76–94%), specificity (70–88%) and negative predictive values (97–99%). Item 1 (sadness) performed the best of the individual items (48% with a positive response to the item had MDD; 3% with a negative response had MDD; over 80% of patients with MDD were correctly identified). A combination of questions about sadness and loss of interest performed best among the two-question combinations (37% with positive response had MDD *v* 1% with a negative response; 94% of patients with MDD were identified).
Conclusions: One to two questions regarding sadness and loss of interest serve as simple and effective screening tools for post-MI depression.

Major depression after myocardial infarction (MI) is a common and serious condition, affecting 15–30% of post-MI patients in the 18 months after their cardiac event.[1] Frasure-Smith and colleagues'[2 3] landmark work in the 1990s found that post-MI depression was associated with cardiac mortality at six and 18 months after MI, and that the impact of depression on mortality was independent of medical or demographic variables. A multitude of studies since that time have largely confirmed their findings, with a recent meta-analysis of 22 articles finding that post-MI depression was associated with a greater than twofold risk of death within 18 months after the acute cardiac event.[4] In addition to affecting mortality, post-MI depression is associated with recurrent cardiac events, impaired quality of life and poor social function.[5 6]

Despite its prevalence and importance, depression remains substantially under-recognised in medical settings. In the primary care setting, about 50% of depressed patients are not recognised as such[7 8]; in inpatient medical settings, about three quarters of patients with current depression go undiagnosed and hence untreated.[9 10] Depressed post-MI patients on busy inpatient cardiac units may be especially in danger of underdiagnosis, as shown by studies that suggest a rate of recognition and treatment of around 10%.[1 2] Given the profound impact of depression and the low rates of recognition, systematic screening of patients in medical settings for depression has been recommended. A recent review[11] found that formal screening of primary care patients resulted in a reduction of persistent depression, and it appears that short instruments—as short as two-question screens—may be as effective as more comprehensive screening tools in primary care and cardiac patients.[11 12] Fortunately, treatments for depression (and, specifically, post-MI depression) are available and effective,[13–15] so if recognition can be improved, then treatment of post-MI depression may have a substantial impact on both quality of life and survival.

Development of effective screening methods for post-MI depression is therefore an important goal. On inpatient cardiac units, having screening tools that are brief and easy to use is particularly important, given the high medical acuity and rapid turnover on these units. To our knowledge, the utility of very brief screening tools (one to two items) in diagnosing major depressive disorder (MDD) among hospitalised post-MI patients has not been investigated. In this study, we examined the ability of questions (regarding depressed mood, loss of interest and loss of pleasure) from the Beck Depression Inventory II (BDI-II)[16] to identify patients with MDD.

METHODS

Design

This was a prospective observational study examining the ability of three screening questions from the BDI-II to identify post-MI patients with current MDD. It was part of a broader observational study investigating the impact of post-MI symptoms (as measured by the BDI-II and by formal MDD criteria) on cardiac outcomes.

Abbreviations: BDI-II, Beck Depression Inventory II; DSM-IV, *Diagnostic and statistical manual of mental disorders*, 4th ed; ENRICHD, Enhancing Recovery in Coronary Heart Disease Patients; MDD, major depressive disorder; MI, myocardial infarction; SADHART, Sertraline Antidepressant Heart Attack Randomized Trial; SCID, *Structured clinical interview for DSM-IV Axis I disorders*

Subject selection and procedures

The study was approved by the Institutional Review Board of Massachusetts General Hospital. Patients admitted to the Massachusetts General Hospital Coronary Care Unit or Cardiac Step-Down Unit between October 2003 and July 2005 with a primary diagnosis of MI were recruited within 72 h of symptom onset for entrance into the study. Inclusion and exclusion criteria were similar to those of comparable studies of post-MI psychiatric syndromes.[2 3 17] Specifically, eligible patients met at least two of the three following World Health Organization[18] and Joint European Society of Cardiology/American College of Cardiology Committee for the Redefinition of Myocardial Infarction[19] criteria for an acute MI: typical chest pain, raised cardiac enzymes (troponin T greater than 0.10 ng/ml or creatine kinase MB fraction greater than 1.5 times the upper limit of normal) and ECG changes consistent with MI.

Exclusion criteria were periprocedural MIs, cognitive difficulties that interfered with a patient's ability to provide informed consent or to complete a baseline interview, and not being medically stable enough to complete the baseline evaluation. In addition, patients with substance abuse or dependence (identified by the *Structured clinical interview for DSM-IV Axis I disorders* (SCID)[20] modules for substance abuse and dependence) were excluded to reduce the possibility of substance withdrawal as a cause of psychiatric symptoms.

Physician study staff (JCH, FAS) then conducted an initial verbal screening battery for each participant. This battery included the full BDI-II and the SCID for current MDD. The three screening items in question from the BDI-II were item 1 (depressed mood), item 4 (loss of pleasure) and item 12 (loss of interest). These items were chosen a priori, as depressed mood and anhedonia have been identified by the *Diagnostic and statistical manual of mental disorders*, 4th ed (DSM-IV)[21] as core required symptoms of depression, and the US Preventive Services Task Force has recommended screening for these two symptoms to identify depression.[11] For each of these items, the researchers noted a ''positive response'' (score of 1 or more on the item) or ''negative response'' (score of 0) for the preceding two weeks. Specifically, a positive response for these items was an affirmative answer to ''I feel sad much of the time'' (item 1), ''I don't enjoy things as much as I used to'' (item 4) and ''I am less interested in other people or things than before'' (item 12). Items 1 and 4 (1/4) and items 1 and 12 (1/12) were also considered together as two-question screening batteries, with a positive response to either question regarded as a positive response.

Statistical analysis

Data were analysed with SPSS for Windows (release 11.0.1; SPSS Inc, Chicago, Illinois, USA). This statistical package was used to identify the medical and demographic characteristics of the population, the rate of MDD in the cohort, and responses to the three individual BDI-II items and both two-question screening batteries (1/4, 1/12).

The ability of the three individual BDI-II items and the two combined (two-question) items to correlate with the criterion standard (MDD meeting DSM-IV criteria as diagnosed by formal interview) was calculated by standard formulas.[22] Specifically, we calculated sensitivity, specificity, positive and negative predictive values, overall correct classification and odds ratio for each of the screening tools.

RESULTS

One hundred and eighty eligible post-MI patients were approached for participation in the study; 49 (27%) declined or met exclusion criteria. The remaining 131 patients were enrolled in the study. The demographic characteristics of this population overall were similar to those in other studies of post-MI patients.[2 17 23] The average age of participants was 62.2 (SD 12.6) years, 105 patients (80%) were men, 83 (63%) were married and 38 (29%) lived alone. Most patients had two or more cardiac risk factors, with 58% having hyperlipidaemia, 51% having hypertension, 24% being current smokers and 18% having diabetes mellitus; this was the first MI for 80% of the participants. With regard to psychiatric status, 30 patients (23%) had experienced a major depressive episode before the preceding two weeks. Seventeen of the 131 patients (13%) met criteria for current MDD by DSM-IV criteria.

With respect to MI, 73% of patients had an ST elevation MI, with median peak creatine kinase of 1101 U/l (25–75th centile: 292.5–2275 U/l), median peak creatine kinase (MB fraction) of 104.2 ng/ml (25–75th centile: 21.4–227.6 ng/ml) and median peak troponin T of 2.99 ng/dl (25–75th centile: 0.89–6.94). Mean left ventricular ejection fraction was 0.516 (0.135). During hospitalisation, 98% of patients received β blockers, 80% received angiotensin-converting enzyme inhibitors and 99% received lipid-lowering agents; 53% received at least one dose of benzodiazepine and 12% received an antidepressant.

Individual BDI-II items

Table 1 summarises the correlation of the individual BDI-II items (1, 4 and 12) with MDD. Table 2 shows the diagnostic efficiency statistics.

Overall, all three items had similar sensitivity (76–87%), specificity (82–88%) and negative predictive values (97–98%). Of these single items, item 1 served as the most effective screening question. This item had the best sensitivity and positive predictive value of the individual items and had the best overall correct classification (86.3%) of any item or combination of items.

Two-question BDI-II combinations

Tables 1 and 2 also summarise the statistical properties of the two-item combinations as screening tools for MDD in this cohort. Sensitivity was 94% for both combinations, and specificity was 70–76%. Negative predictive value was 99% for both tools. Of these two tools, the screening panel of item 1 (sadness) plus item 12 (loss of interest) was more efficient, as 16 of 43 (37%) patients with a positive response to either question had MDD and only one of 88 (1%) with a negative response to both questions had MDD; this two-item screen identified two more patients (16; 94%) with MDD than did the most efficient single-item screen (14; 82%), although a formal interview of 14 more patients would have been required to identify the two additional cases of depression.

DISCUSSION

The primary finding of this study is that one to two questions from the BDI-II were effective in screening post-MI patients for MDD. Overall, all three individual items were good screening tools for MDD in this post-MI population, with relatively high sensitivity and specificity. The negative predictive value for the items, important for an acceptable screening tool, was also very good (97–98%). Item 1 of the BDI-II, essentially, ''Have you felt sad much of the time in the past two weeks?'' was the most effective single question and in some ways was a more efficient screening tool than combinations of two questions. Among patients in this study, a positive response to this item correlated with an about 50% chance (14/29; 48%) of having MDD, whereas a negative response correlated with a 3% chance (3/102) of having MDD. Single items regarding loss of pleasure and interest were also effective screening tools but were less efficient than item 1.

Table 1 Effectiveness of BDI-II items in screening for MDD

BDI item(s)	Positive response to screening item	MDD if positive screen (%)	MDD if negative screen (%)	Total patients with MDD identified by screen (%)	NNI
1	29/131	48.3% (14/29)*	2.9% (3/102)	82.4% (14/17)	2.07*
4	42/131	35.7% (15/42)	2.2% (2/89)	88.2% (15/17)	2.80
12	32/121	43.8% (14/32)	3.0% (3/99)	82.4% (14/17)	2.28
1/4	50/131	32.0% (16/50)	1.2% (1/81)	94.1% (16/17)*	3.13
1/12	43/131	37.2% (16/43)	1.1% (1/88)*	94.1% (16/17)*	2.69

*Best values (for example, item 1 has highest rate of MDD with positive response) among all items.
BDI, Beck Depression Inventory II; MDD, major depressive disorder; NNI, number needed to interview to identify one patient with MDD after positive screen.

Two-question combinations of item 1 plus loss of either pleasure (4) or interest (12) also proved highly useful in identifying patients with depression. These items had even higher sensitivity and negative predictive value than the individual items. This use of two questions is appealing because it was able to identify a greater majority of depressed patients (16/17 in each case; 94.1%) and because this screening method mirrors DSM-IV criteria, which require either depressed mood or anhedonia to have been present over the preceding two weeks. However, these two-question screens had higher rates of false positives and would require more patients to be formally interviewed by busy clinicians in a real-world setting. Of the two-question combinations, the combination of 1 and 12 was the best, with 43 patients giving an affirmative response, of whom 16 met MDD criteria. In our study, we chose to use items from the BDI-II rather than stand alone screening tools such as the Patient Health Questionnaire-2 (a two-item depression screening tool validated in medical settings)[24] because the BDI has been most studied in this population and has been most associated with negative cardiac outcomes.[3 25] The BDI-II is an updated version of the original BDI.

In context, these findings match those of depression screening in non-MI populations. The most similar screening methods have used one or two questions. Wells and co-workers,[26] studying primary care outpatients, used depressed mood or anhedonia lasting two weeks during the preceding year plus at least one week of depression in the preceding month as a positive screen for depression. They found the positive predictive value of this instrument to be 55%, slightly higher than the item with the highest positive predictive value in our study (item 1; 48%). Chochinov and associates,[27] studying depression in terminally ill cancer patients, found that a single question, ''Are you depressed?'' served as an excellent screening tool for major or minor depression, minimally better than a two-item tool (for depression and anhedonia) and much better than the total BDI[28] or a visual analogue scale. In that study, all 24 patients with a depressive disorder (15 with MDD and nine with minor depression) responded positively to the one-item screen, with no false positives.

Our results are also similar to those of a recent study of diagnostic screening methods in outpatients with cardiac disease by McManus and co-workers.[12] The authors examined a variety of screening methods to diagnose depression among a large cohort of outpatients with coronary heart disease. They found that a variety of screening tools correlated well with a formal interview diagnosis of MDD; importantly, they found that a two-question screening test (essentially asking about depressed mood and loss of interest or pleasure in the past month) was an excellent screening tool. A positive response to one of these two questions was 90% sensitive and 69% specific for depression, similar to the 94% and 76% values of the two-question screen in our study.

Our findings are clinically important because of the importance of identifying depression among patients with acute MI. Post-MI depression is an important clinical syndrome, associated with poor function, recurrent cardiac events and death. Historically, rates of recognition of depression among MI patients have been very low, about 10%.[1] By using a more formalised survey of providers, Ziegelstein and co-workers[29] found that clinicians on cardiac inpatient units poorly recognised post-MI symptoms of depression as measured by the BDI. Providers' assessments of depression in that study had low sensitivity and specificity, and frequent false-positive and false-negative errors.

Among patients who are recognised as depressed, treatment of post-MI depression with antidepressants and cognitive-behavioural therapy is efficacious, as seen in the large SADHART (Sertraline Antidepressant Heart Attack Randomized Trial)[13] and ENRICHD (Enhancing Recovery in Coronary Heart Disease Patients)[14] trials. Additionally, emerging data suggest that treatment of post-MI depression with selective serotonin reuptake inhibitors may positively affect cardiac outcomes,[13 15] although such data thus far have come only from post hoc analysis of studies that were not prospectively designed to study the link between antidepressant treatment and cardiac outcome. In sum, post-MI depression is a dangerous and under recognised, but treatable, condition.

A potential real-world application of our data would be to implement a two-step screening process for post-MI

Table 2 Summary of all statistical characteristics of BDI-II items as depression screening tools

BDI item(s)	Positive response to screening item	Sensitivity (%)	Specificity (%)	PPV	NPV	OCC	OR
1	29/131	82.4	86.8*	48.3*	97.1	86.3*	30.8
4	42/131	88.2	76.3	35.7	97.8	77.9	24.1
12	32/121	82.4	84.2	43.8	97.0	84.0	24.9
1/ 4	50/131	94.1*	70.2	32.0	98.8	73.3	37.6
1/12	43/131	94.1*	76.3	37.2	98.9*	78.6	51.6*

*Best values among all items.
BDI, Beck Depression Inventory II; NPV, negative predictive value; OCC, overall correct classification; OR, odds ratio; PPV, positive predictive value.

depression on acute cardiac units. The first step would consist of a one- to two-item screen as part of the standardised nursing assessment or physician interview (for example, adapted from item 1 of the BDI-II: ''Have you felt sad much of the time in the past two weeks?''). An affirmative response would lead to the second step—a more formal interview of the patient by using DSM-IV criteria for MDD by the cardiologist or a consulting psychiatrist. This 5 min interview would specifically consist of determining whether the patient endorsed five of nine symptoms of depression (depressed mood, anhedonia, anergia, appetite change, guilt/worthlessness, poor concentration, sleep change, psychomotor slowing/agitation and recurring thoughts of death) for most of the day or nearly every day for two weeks, as outlined in the diagnostic criteria; patients identified as having MDD could then be treated. This two-step process would have the advantage of providing a simple screening method that would substantially reduce the number of patients who required formal interview, while still identifying the vast majority of patients with MDD. In most clinical settings, the one-item screen would be more practical and efficient. On the basis of the data from our study, a one-question screen of 131 patients with MI would require formal interview of only 29 patients, about half of whom (14) would have MDD. In clinical settings in which clinicians had more time and a desire to identify the greatest number of depressed patients, a two-question screen could be used. This two-item screen would require interview of more (43) patients but would identify more than 90% of the patients with MDD (16; 94%).

This study was limited by being performed in a single academic medical setting, on two cardiac units and with only a moderate number (131) of patients; these factors mean that our findings may not be generalisable to all patients. Although the other demographic and medical variables of the sample were largely similar to those of other studies of this population, the percentage of ST elevation MIs was relatively high, probably because more than half of the patients were recruited from the coronary intensive care unit, which houses patients who are immediately post-intervention or have more tenuous cardiac status, both populations in which ST elevation MI is more likely. In addition, the screening questions and diagnostic interviews were part of a battery of questions rather than serving as stand alone screening questions; these factors may have influenced responses, and follow-up studies should ask these questions in a stand alone manner. The psychiatrists who performed the SCID for MDD were aware of the patients' BDI-II responses, potentially creating a bias towards increased agreement of BDI-II scores and formal MDD. Lastly, it is unknown whether the approximately 25% of patients who declined or were ineligible for the study (we did not record numbers of patients for each reason for exclusion or refusal) may have had different patterns of response.

In conclusion, we suggest that a single question about sadness and two questions about sadness and loss of interest are simple to administer on busy cardiac units, are highly effective as screening tools for MDD in patients within 72 h of MI, and may permit vastly improved rates of recognition and treatment of MDD among MI patients. Given the significant impact of post-MI depression on recurrence, quality of life and mortality, and given the poor recognition rate of post-MI depression in the absence of formal screening, the implementation of simple screening methods followed by formal diagnostic follow-up interviews can have a profound impact on the emotional and cardiac health of these patients.

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IMAGES IN CARDIOLOGY

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Sneddon's syndrome: cardiac involvement detected by magnetic resonance imaging

We report the case of a 37-year-old woman presenting with progressive livedo racemosa (panel A), limited physical capabilities and behavioural disorders. Cerebral magnetic resonance imaging (MRI) showed multiple hyperintense white matter lesions on T2-weighted images indicating cerebral vasculitis. ECG on admission demonstrated bigeminal rhythm, incomplete right bundle branch block and disturbances of repolarisation. Cardiac MRI showed an impaired ejection fraction of 43% and a focal area of apical myocardial oedema on T2-weighted images (panels C and D). T1-weighted inversion recovery images revealed multiple spots of delayed enhancement in the left ventricular myocardium (panels E and F) resulting in the diagnosis of cardiac vasculopathy within Sneddon's syndrome. Histological examination of a subcutaneous biopsy showed typical vascular occlusions (panel B) and confirmed the diagnosis. To our knowledge, we present the MR images of cardiac involvement in Sneddon's syndrome.

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