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Relationship between Two Depression Scales and Quality of Life in Patients Undergoing Surgical Coronary Revascularization: A MOTIV-CABG Substudy

Andréa Perrotti[1]*, Francesco Monaco[1], Pierre Vandel[2], Camille Durst[1], Fiona Ecarnot[3] and Sidney Chocron[1]

[1]Department of Thoracic and Cardio-Vascular Surgery, EA3920, University Hospital Jean Minjoz, 25000 Besançon, France
[2]Department of Psychiatry, University Hospital Jean Minjoz, 25000 Besançon, France
[3]Department of Cardiology, EA3920, University Hospital Jean Minjoz, 25000 Besançon, France

Abstract

Objective: The MOTIV-CABG trial evaluated the efficacy of antidepressant therapy (Escitalopram) in patients undergoing coronary artery bypass grafting (CABG). Quality of life was assessed using the 36-Item Short Form health survey (SF-36). Depression was assessed using the Beck Depression Inventory short-form (BDI-SF) and the Center for Epidemiological Studies Depression scale (CES-D). We compared the relation between each of these scales, and quality of life.

Methods: We analyzed 1674/1805 questionnaires (93%). Respondents were classified into 4 groups: D+both corresponds to patients classed as depressive by both BDI-SF and CES-D, D-both to patients classed as non-depressive by both BDI-SF and CES-D, D+BDI to patients classed as depressive by BDI-SF and non-depressive by CES-D, D+CES to patients classed as non-depressive by BDI-SF and depressive by CES-D.

Results: The values of Group D+BDI and D+CES were within the range of values of groups D+both and D-both for all SF-36 items. The difference between D+both and D-both was significant for all SF-36 items, including the mental (MCS) and physical component scores (PCS). The PCS was significantly lower in Group D+BDI vs Group D+CES, while the MCS was significantly lower in Group D+CES vs Group D+BDI. There was agreement between BDI and CES-D findings in 1522 questionnaires (83%) and discordance in 318 (17%) (kappa 0.52 (95% CI 0.47-0.57)).

Conclusions: BDI and CES-D are sensitive to different aspects of the effect of depression on quality of life. The integrated use of these scales can be helpful in identifying areas that require specific treatments in patients undergoing CABG.

Keywords: Depression; Quality of life; Coronary artery bypass grafts

Introduction

The incidence of depression is high in patients with coronary artery disease, with 20% reported to have severe depression and 25% moderate depression [1]. Depression increases mortality and morbidity, independently of the severity of coronary lesions or left ventricular impairment [2]. This phenomenon is compounded in patients who are waiting for, or have recently undergone surgical coronary revascularization. Burker et al. [3] showed that 47% of patients waiting for surgery and 61% of patients who had undergone surgery for coronary revascularization had depressive symptoms, while Connerney [4] reported that depressed patients were more likely to present complications after heart surgery. Indeed, depression is not only associated with organic complications, but also with a significant impairment of role functioning, as well as daily social and psychological well-being. The functional disability is increased, and the longer the patient remains symptomatic, the lower the chances of a complete recovery, thus perpetuating dysfunction.

In this regard, heart surgery presents some interesting characteristics as a model for examining the structural and temporal aspects of depressive symptoms. It involves both a chronic medical condition (atherosclerosis and/or valve disease) with symptomatic and functional effects, and a significant life event (major surgery). Moreover, unlike many stressful events, major surgery is a crisis in the sense of a turning point that, once resolved, may have either significant positive (symptom relief, improved functioning) or negative consequences (complications, death). Adaptive challenges faced by patients undergoing heart surgery are different and more complex than those of patients who may be facing either a health crisis or a chronic medical condition but not both [5].

The MOTIV-CABG trial was designed to test the efficacy of antidepressant therapy by escitalopram in patients undergoing coronary artery bypass grafting (CABG) [6]. The primary composite endpoint was the occurrence of death or morbidity events during the 12 month postoperative period. Secondary endpoints were the quantitative measurement of depression through the administration of the Beck Depression Inventory short-form (BDI-SF), and of quality of life using the 36-Item short form scale (SF-36). During each follow-up visit (before surgery and at months 1, 3, 6, and 12 after surgery) patients completed the BDI-SF, the Center for Epidemiologic Studies Depression Scale (CES-D), and the SF-36.

Using the data from the MOTIV-CABG trial, we aimed to evaluate the relationship between each depression scale (BDI-SF and CES-D) and quality of life as assessed by the SF-36 questionnaire in patients who have undergone surgery for coronary revascularization.

***Corresponding author:** Andrea Perrotti, MD,Department of Thoracic and Cardio-Vascular Surgery, EA3920, University Hospital Jean Minjoz, Boulevard Fleming, 25000 Besançon, France, Tel: +33 381 668 662; Fax: +33 381 668 661; E-mail: a.perrotti@hotmail.it

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Methods

Details of the MOTIV-CABG have previously been published [6]. Briefly, the MOTIV-CABG study was a single centre, non-stratified, randomized, double-blind, parallel-group, phase 4 trial conducted between January 2006 and February 2012. The trial was conducted at a single large university hospital (Besancon, France). Eligible subjects were randomized in a 1:1 ratio to receive either escitalopram or placebo. One tablet/day was taken for 14 to 21 days before surgery, and for up to 6 months after surgery (month 6). Eligible subjects were patients aged 30 years old or more, with stable angina pectoris and scheduled to undergo CABG. The trial was sponsored by H. Lundbeck A/S (Copenhagen, Denmark). The protocol was approved by the Institutional Review Board, and written informed consent was obtained from all participants [6].

Self-assessment questionnaires

Patients participating in the MOTIV-CABG study completed three self-report questionnaires at the pre-operative consultation, and at 1, 3, 6 and 12 months after surgery.

1) The Beck Depression Inventory Short Form (BDI-SF) [7,8] consists of 13 items, each scored from 0 to 3, and is used to assess depression in medically ill patients in particular, because it has a totally cognitive component. A score of 0 to 3 indicates no depression; 4 to 7 corresponds to mild depression; 8 to 15 moderate depression; 16 or more, severe depression.

2) The Center for Epidemiologic Studies Depression Scale (CES-D) [9] is a self-report scale consisting of 20 items, each scored from 0 to 3. A score of 0 to 14 indicates no depression; a score of 15 to 21 corresponds to mild to moderate depression; and a score of 21 and more characterizes major depression.

3) The SF-36 is a self-administered 36-item instrument that covers eight dimensions of health. Each dimension is scored on a scale from 0 to 100, with higher scores indicating better health. Two summary scores are also calculated to summarize the patient's physical and mental state of health [7], namely the Physical Component Summary score (PCS) and the Mental Component Summary score (MCS).

The 361 patients included in the study were randomized to take either escitalopram or placebo. Patients completed the BDI-SF, the CES-D and the SF36 at each visit (preoperative, and months 1, 3, 6, and 12 postoperatively), with the result that 1805 questionnaires were available for each instrument. For the purposes of this analysis, patients were classed as depressive according to the BDI-SF if their score was >3 [6], and they were considered as depressive according to the CES-D if their score was >14 [6].

Patients were classified into 4 groups. The groups were defined on the basis of the answers to the BDI-SF and CES-D questionnaires irrespective of whether the patient received escitalopram or placebo. Group D+both corresponds to patients classed as depressive by both the BDI-SF and the CES-D. Group D-both corresponds to patients classed as non-depressive by both instruments. Group D+BDI corresponds to patients classed as depressive by the BDI-SF but non-depressive by the CES-D, and Group D+CES corresponds to patients classed as non-depressive by the BDI-SF and depressive by the CES-D.

Statistical analysis

To compare the differences in repeated measures of continuous data between the groups, repeated-measures analysis of variance (ANOVA) was used. This method allowed for a comparison between groups (D+both, D-both, D+BDI and D-CES), and to test interactions between treatment allocation (escitalopram versus placebo), visit, and depression. The p values less than 0.05 were used to indicate statistical significance. Statistical analyses were performed using SAS version 9.2 software (SAS Institute. Cary. NC).

Results

Due to missing values, 1674/1805 (93%) questionnaires were analysed for each instrument. There was agreement between the BDI-SF and the CES-D in 1522 patients (83%), and lack of agreement in 318 (17%) (kappa coefficient 0.52 (95%CI 0.47-0.57). Table 1 details the average SF-36 scores in each of the four groups of depression (D+both, D-both, D+BDI and D+CES). Values of D+both and D-both are

SF 36 items	Depression group	Mean ± SD
Physical Component Summary (PCS)	D-both	45.71 ± 8.69
	D+both	37.96 ± 8.84
	D+CES	41.83 ± 7.85
	D+BDI	38.33 ± 8.76
Mental Component Summary (MCS)	D-both	55.23 ± 7.42
	D+both	37.80 ± 8.52
	D+CES	44.96 ± 9.00
	D+BDI	47.56 ± 7.55
Physical Functioning (PF)	D-both	77.39 ± 21.43
	D+both	58.68 ± 24.98
	D+CES	64.52 ± 24.17
	D+BDI	60.47 ± 25.14
Role Physical (RP)	D-both	54.13 ± 40.34
	D+both	19.71 ± 29.06
	D+CES	34.84 ± 39.16
	D+BDI	24.76 ± 33.51
Bodily Pain (BP)	D-both	72.17 ± 21.82
	D+both	48.47 ± 21.17
	D+CES	57.97 ± 22.98
	D+BDI	57.28 ± 21.82
General Health (GH)	D-both	73.94 ± 15.57
	D+both	49.89 ± 16.78
	D+CES	61.88 ± 15.21
	D+BDI	60.66 ± 15.99
Vitality (VT)	D-both	66.13 ± 15.99
	D+both	38.63 ± 14.79
	D+CES	51.49 ± 15.06
	D+BDI	49.30 ± 15.42
Social Functioning (SF)	D-both	87.34 ± 15.91
	D+both	56.62 ± 19.56
	D+CES	71.25 ± 19.04
	D+BDI	75.41 ± 19.94
Role Emotional (RE)	D-both	69.18 ± 37.63
	D+both	21.15 ± 31.84
	D+CES	35.19 ± 40.73
	D+BDI	34.58 ± 38.09
Mental Health (MH)	D-both	81.59 ± 12.85
	D+both	52.70 ± 15.43
	D+CES	65.30 ± 16.08
	D+BDI	71.08 ± 12.94

Note: SD, standard deviation; D+both: patients classed as depressive by both instruments; D-both: patients classed as non-depressive by both instruments; D+BDI: patients classed as depressive by the BDI-SF but non-depressive by the CES-D; D+CES: patients classed as non-depressive by the BDI-SF and depressive by the CES-D.

Table 1: Average SF-36 scores in each of the four groups of depression (D+both, D-both, D+BDI and D+CES).

significantly different for all SF-36 items. The values of Group D+BDI and D+CES were within the range of values of group D+both and D-both for all items. Table 2 shows the mean score difference between groups for the SF-36 aggregate scores and each item of SF-36 scores. The difference between D+both and D-both was significant for all SF-36 items, including MCS and PCS. For groups D+BDI and D+CES, There was a discrepancy. For the aggregate scores, PCS was significantly lower in D+BDI than in D+CES, whereas MCS was significantly lower in Group D+CES than in Group D+BDI. Similarly, Mental Health was significantly lower in Group D+CES than in Group D+BDI, when Role Physical was significantly lower in D+BDI than in D+CES. For all other SF-36 items, the differences between Group D+BDI and Group D+CES were not significant.

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	95% Confidence Interval		P value
				Lower Bound	Upper Bound	
PCS	D+both	D-both	-7.76	-9.34	-6.17	<0.01
		D+BDI	-0.38	-2.61	1.85	1.00
		D+CES	-3.87	-6.36	-1.39	<0.01
	D-both	D+BDI	7.38	5.53	9.23	<0.01
		D+CES	3.88	1.73	6.04	<0.01
	D+BDI	D+CES	-3.49	-6.16	-0.83	<0.01
MCS	D+both	D-both	-17.43	-18.88	-15.97	<0.01
		D+BDI	-9.76	-11.81	-7.72	<0.01
		D+CES	-7.16	-9.44	-4.88	<0.01
	D-both	D+BDI	10.24	7.70	12.78	<0.01
		D+CES	10.27	8.29	12.25	<0.01
	D+BDI	D+CES	2.61	0.16	5.05	0.03
Physical Functioning (PF)	D+both	D-both	-18.54	-22.65	-14.42	<0.01
		D+BDI	-1.81	-7.60	3.98	1.00
		D+CES	-6.60	-13.07	-0.13	0.04
	D-both	D+BDI	16.73	11.91	21.54	<0.01
		D+CES	11.93	6.33	17.54	<0.01
	D+BDI	D+CES	-4.79	-11.73	2.14	0.41
Role Physical (RP)	D+both	D-both	-34.84	-41.53	-28.15	<0.01
		D+BDI	-3.97	-13.38	5.44	1.00
		D+CES	-16.49	-27.00	-5.98	<0.01
	D-both	D+BDI	30.88	23.05	38.70	<0.01
		D+CES	18.36	9.24	27.47	<0.01
	D+BDI	D+CES	-12.52	-23.78	-1.26	0.02
Bodily Pain (BP)	D+both	D-both	-23.95	-27.96	-19.94	<0.01
		D+BDI	-8.59	-14.23	-2.94	<0.01
		D+CES	-10.42	-16.73	-4.12	<0.01
	D-both	D+BDI	15.36	10.67	20.06	<0.01
		D+CES	13.52	8.06	18.99	<0.01
	D+BDI	D+CES	-1.84	-8.59	4.92	1.00
General Health (GH)	D+both	D-both	-23.99	-26.89	-21.08	<0.01
		D+BDI	-10.79	-14.87	-6.70	<0.01
		D+CES	-12.60	-17.16	-8.04	<0.01
	D-both	D+BDI	13.20	9.80	16.60	<0.01
		D+CES	11.39	7.43	15.34	<0.01
	D+BDI	D+CES	-1.81	-6.70	3.08	1.00
Vitality (VT)	D+both	D-both	-27.45	-30.39	-24.51	<0.01
		D+BDI	-10.31	-14.45	-6.17	<0.01
		D+CES	-12.35	-16.97	-7.73	<0.01
	D-both	D+BDI	17.14	13.70	20.58	<0.01
		D+CES	15.10	11.09	19.11	<0.01
	D+BDI	D+CES	-2.04	-6.99	2.91	1.00
Social Functioning (SF)	D+both	D-both	-30.89	-34.09	-27.69	<0.01
		D+BDI	-18.40	-22.90	-13.90	<0.01
		D+CES	-15.30	-20.33	-10.28	<0.01
	D-both	D+BDI	12.49	8.75	16.23	<0.01
		D+CES	15.58	11.23	19.94	<0.01
	D+BDI	D+CES	3.10	-2.29	8.48	0.77
Role Emotional (RE)	D+both	D-both	-48.51	-55.39	-41.64	<0.01
		D+BDI	-13.15	-22.82	-3.48	<0.01
		D+CES	-15.72	-26.52	-4.92	<0.01
	D-both	D+BDI	35.36	27.32	43.41	<0.01
		D+CES	32.80	23.43	42.16	<0.01
	D+BDI	D+CES	-2.57	-14.14	9.01	1.00
Mental Health (MH)	D+both	D-both	-28.84	-31.34	-26.34	<0.01
		D+BDI	-18.59	-22.11	-15.07	<0.01
		D+CES	-12.28	-16.21	-8.36	<0.01
	D-both	D+BDI	10.25	7.32	13.17	<0.01
		D+CES	16.55	13.15	19.96	<0.01
	D+BDI	D+CES	6.31	2.10	10.52	<0.01

Note: PCS: Physical Component Summary score; MCS: Mental Component Summary score; D+both: patients classed as depressive by both instruments; D-both: patients classed as non-depressive by both instruments; D+BDI: patients classed as depressive by the BDI-SF but non-depressive by the CES-D; D+CES: patients classed as non-depressive by the BDI-SF and depressive by the CES-D.

Table 2: Comparison between groups of aggregate scores and of each SF-36 item.

The Between-Subjects effects for aggregate scores are reported in Table 3. The results are similar for each SF-36 item (data not shown). Tables 2 and 3 show that the treatment group does not influence the analysis. Conversely, there is an interaction between visit and depression.

Discussion

Depression is a leading cause of disability worldwide, accounting for 40.5% of the disability-adjusted life years (DALYs) caused by mental disorders, and it significantly affects QoL. The relationship between depression and QoL in patients with cardiovascular disease has been studied extensively using different methods in recent years. Steca et al. found a significant relationship between illness severity and health satisfaction and depression in cardiovascular disease patients, but these relationships were fully mediated by illness perception and self-efficacy beliefs (both were indicators of patients' psychological well-being). Therefore, mental disorders (such as depression) are frequently comorbid with cardiovascular disease and indeed, there is some evidence suggesting that they influence QoL, such as an inverse relationship between depression intensity, its severity and QoL [10].

The BDI-SF and CES-D are two widely used depression scales. The BDI assesses cognitive, behavioural, affective and somatic dimensions of depression [11]; while the CES-D was designed to identify depressive symptoms among the general population [12]. Despite the fact that both were designed to evaluate depressive symptomatology, they do not assess depression in the same manner, since they explore different dimensions of depression. The CES-D measures the "current" level of depressive symptoms, which is expected to vary over time, and has been shown to have excellent reliability and concurrent validity [9,12]. It is sensitive to the levels of severity of depressive symptoms, and reflects improvements after psychiatric treatment. Moreover, the CES-D is designed to be sensitive to possible depressive reactions to major events in a person's life and for this reason, it is increasingly used in research in cardiovascular disorders [5].

The BDI is probably the best known and most widely used depression scale [13] because it may be more useful for measuring

Dependent Variable:PCS					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**P-value**
Corrected Model	30179.35	39.00	773.83	11.48	0.00
Intercept	1199045.38	1.00	1199045.38	17788.59	0.00
trt_grp	15.58	1.00	15.58	0.23	0.63
VISIT	3065.58	4.00	766.40	11.37	<0.01
Depression	13056.41	3.00	4352.14	64.57	<0.01
trt_grp * VISIT	99.85	4.00	24.96	0.37	0.83
trt_grp * Depression	195.11	3.00	65.04	0.97	0.41
VISIT * Depression	2038.34	12.00	169.86	2.52	<0.01
trt_grp * VISIT * Depression	460.91	12.00	38.41	0.57	0.87
Dependent Variable:MCS					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**P-value**
Corrected Model	70729.77	39.00	1813.58	31.96	0.00
Intercept	1536227.56	1.00	1536227.56	27067.79	0.00
trt_grp	125.32	1.00	125.32	2.21	0.14
VISIT	2663.01	4.00	665.75	11.73	<0.01
Depression	53869.36	3.00	17956.45	316.39	<0.01
trt_grp * VISIT	181.08	4.00	45.27	0.80	0.53
trt_grp * Depression	89.10	3.00	29.70	0.52	0.67
VISIT * Depression	1847.50	12.00	153.96	2.71	<0.01
trt_grp * VISIT * Depression	707.94	12.00	59.00	1.04	0.41

Note: Df: degrees of freedom; trt_grp: treatment group; PCS: Physical Component Summary; MCS: Mental Component Summary.

Table 3: Between-Subjects Effects for SF-36 aggregate scores.

the severity of depression in clinical populations, and as an index of treatment response. The advantages of the BDI include its high internal consistency, high content validity, validity in differentiating between depressed and non-depressed subjects and sensitivity to change. Conversely, reported shortcomings of the BDI include its high item difficulty, instability of scores over short time intervals (over the course of 1 day), it is less useful in elderly or neglected patients, and it also has a high rate of false positives [12]. The BDI Short Form is especially used to assess depression in medically ill patients, because it eliminates the somatic component of the test, which may be a confounder [11].

Depression symptoms have been shown to increase morbidity and mortality after open-heart surgery [2], and they are associated with worse outcomes after CABG, often with a marked alteration in quality of life [4,14,15]. In the current study, we compared the relationship between each depression instrument and quality of life in patients who had undergone CABG.

Our study shows that, although there was fair agreement between the two scales, with 83% agreement and a kappa coefficient of 0.52, the information yielded by each questionnaire was valuable. We can notice that for all SF-36 items as well as for the aggregates scores, the scores of group D+BDI and D+CES were included in the range of values of group D+both and D-both. Our results also show that, in patients undergoing CABG, the CES-D, as compared to the BDI, shows statistical and clinical significance in detecting the impact of depression on the affective aspects of quality of life. Actually, patients shown as depressive only by CES-D have significantly lower scores of MCS and Mental Health than patients shown as depressive only by BDI (MCS : (D+BDI – D+CES) = 2.61 [0.16-5.05] (p = 0.03); Mental Health, (D+BDI – D+CES) = 6.31 [2.10-10.52] (p<0.01)). Conversely, BDI, however, has greater sensitivity in determining the impact of depression on the physical component of quality of life (PCS : (D+BDI – D+CES) = -3.49 [-6.16 to -0.83] (p<0.01); Role physical, (D+BDI – D+CES) = -12.52 [-23.78 to -1.26] (p<0.01)). The fact that, conversely to D+BDI and D+CES, values of D+both and D-both are significantly different for all SF-36 items, show the interest of using the two scales.

Several studies have used the BDI and CES-D interchangeably to assess the presence of depression, suggesting that these two scales could be used to measure the same construct and that they have adequately similar psychometric properties [16]. However, other studies have shown that the BDI and CES-D actually represent two different aspects of the same higher level construct (i.e. depression) [17]. In the literature, the two scales differ with respect to the level of depressive symptoms that they optimally assessed [9]. One such dissimilarity is that the CES-D emphasizes the affective component of depression, whereas the BDI has a much stronger cognitive component [17]. Research on clinical samples does not demonstrate superiority of either the BDI or the CES-D as a depression screening tool [18]. Indeed, at higher levels of depression severity (in clinically depressed individuals), the behavioural components of depression are prominent, whereas at lower levels (in the general population), the sensitive components better differentiate between degrees of non-clinical depression.

Strengths and Limitations

Our study has several limitations. One of these is that the study population was selected according to the inclusion and non-inclusion criteria of a clinical trial. The results can therefore only be generalized to patients eligible for the trial. Moreover, missing scores occurred when patients missed a visit or discontinued monitoring. On the other hand, few studies have correlated both scales in a population who have undergone CABG. This study have tested, in a population undergoing specific cardiac surgical intervention, two psychometric scales (BDI and CES-D) built for same diagnostic purposes, i.e depression, and have shown that CES-D and BDI are useful to ascertain the different facets of the impact that depression has on quality of life.

Conclusion

Our study confirms that, in patients who have undergone CABG, CES-D and BDI are useful to ascertain the different facets of the impact that depression has on quality of life. The BDI, has greater sensitivity in determining the impact that depression has on the physical component of quality of life, where as the CES-D has greater sensitivity in determining the impact that depression has on the mental component of quality of life.Thus, the BDI and CES-D scales should not be used interchangeably, but rather, the two scales complement each other.

Acknowledments

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