Risk factors of depressive and anxiety symptoms 8 years after coronary artery bypass grafting

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Received 10 February 2011; received in revised form 8 June 2011; accepted 14 June 2011

Abstract

OBJECTIVE: The aim was to assess the severity and course of self-reported depressive and anxiety symptoms 8 years after coronary artery bypass grafting (CABG).

METHODS: Out of 53 CABG patients, 37 were examined 8 years later (68% men), mean age - 58.2 (SD 9.3) years. They completed the Spielberger State-Trait Anxiety Questionnaire and the Beck Depression Inventory (BDI). Out of the remaining 16 patients, seven died and nine did not respond.

RESULTS: The response group had the mean BDI scores of 13.3 (SD 8.0) before CABG and 11.5 (SD 9.5) at follow-up (p = 0.38). Over 37.8% remained depressed. Non-depressed patients before CABG remained free from depressive symptoms further on, whereas depressed patients continued suffering, even 8 years after the operation. Before the operation, the mean anxiety state score was 44.3 (SD 12.0). After CABG (3 months and 8 years), the significant reduction of anxiety symptoms was observed (respectively: p = 0.02, p = 0.01). Postoperative complications, lower physical and mental well-being, somatic symptoms and negative life attitude were related to bad prognosis several years after surgery.

CONCLUSIONS: Depressive and anxiety symptoms occurred in many cardiosurgical patients before and after CABG. Good results of the surgical procedure did not cause reduction of depressive symptoms. Anxiety symptoms were much more common perioperatively than depressive ones and decreased significantly after surgery. Preoperative assessment of depressive and anxiety symptoms can indicate the risk group and suggest care proceedings during the rehabilitation period to improve the effectiveness of surgical coronary revascularization.

Keywords: Depression • Anxiety • CABG • Predictors

INTRODUCTION

Depressive disorders as well as just the occurrence of several depressive symptoms are a well-known risk factor for coronary heart disease (CHD) and the recovery process after cardiac incidences. It has been estimated that major depression appears in 16–23% of patients with ischemic heart disease, with depressive symptoms in 31–60% [1]. One widely used intervention method for CHD is coronary artery bypass grafting (CABG). Heart surgery reduces the CHD symptoms and mortality rates; however, CABG is still a significant life-threatening event for patients. The presence of depressive symptoms in the perioperative period is also one of the risk factors of the reappearance of this pathology after treatment [2,3].

Depressive manifestations occurring in CABG patients at admission constitute the factor of poor prognosis regarding both worsening of physical and psychological functions and the decrease of the quality-of-life scores [4–7]. They take place even when the result of surgical treatment is satisfactory [2,8,9]. Heart-focused anxiety, diagnosed as anxiety disorder or even several anxiety symptoms, is also very common in CHD patients [2,3,10,11]. Most of the reports show, however, that anxiety reported by patients before the operation demonstrates the tendency to vanish within a few days after a successful procedure [2,3,11]. On the other hand, some studies consider the appearance of anxiety in CABG patients to be a risk factor influencing the postoperative mortality [10].

In this article, the authors’ attention is concentrated on patients suffering from CHD who underwent CABG. Nevertheless, if CHD etiology led to other kinds of heart surgery (such as valvular), it can be expected that these results could also extend to that
group. The core of the problem is the CHD per se, not the particular type of heart surgery. Patients with CHD have so many psychological problems that, despite successful operation, their quality of life and mental well-being could not improve at all.

Following ICD-10 classification, depression is a common mental disorder characterized by diagnostic features such as low or sad mood, loss of interest or pleasure, and several additional symptoms, which can be frequently present (feelings of guilt or loss of self-confidence, disturbed sleep or appetite, fatigue or low energy, decreased libido and poor concentration, agitation or slowing of movement or speech, and suicidal thoughts or acts). Occurrence of several depressive symptoms could not fulfill the criteria of depressive disorders according to ICD-10 or DSM-IV classifications, and was troublesome for the patients. Anxiety disorder is characterized by emotional, somatic, vegetative, and behavioral symptoms (fear, tension, high stress, headache, sweating, muscle spasms, palpitations, and hypertension, which, in some cases, lead to fatigue or even exhaustion). These groups of symptoms or full depressive/anxiety disorder can also become chronic or recurrent and lead to substantial impairments in an individual's ability to take care of his or her everyday responsibilities.

The objective of the study was to assess the incidence, severity, and course of self-reported depressive and anxiety symptoms among patients after CABG during an 8-year observation period and to find the main predictors of those symptoms.

**METHODS**

**Study participants and design**

The study was conducted over 1 year in the Heart Surgery Department of the Wroclaw Medical University. The patients were randomly chosen from among those consecutively admitted to non-emergency CABG under one surgeon. After receiving informed consent, 56 patients who agreed to participate were enrolled in this study. Three of the patients did not complete the tests: two patients died prior to surgery, while CABG for the third patient was abandoned because surgery revealed extensive mediastinal malignancy. Of the 53 patients who were subjected to full tests, 16 were women and 37 were men. Mean age for the whole sample was 58.6 (SD 8.9) years. None of the patients had any psychiatric history. Coronary artery revascularization with bypass grafts (2–4) was carried out using extracorporeal circulation. The patients were examined before CABG (T1), 7–10 days (T2) and 3 months (T3) after CABG [2]. The group was reanalyzed after 8 years (T4) and the closing date for the whole study was January 2009. Seven patients died during this period. Nine patients did not respond, so the final follow-up response rate was 83%. Follow-up examination (T4) was conducted in a group of 37 patients (12 women and 25 men), whose mean age at the beginning was 58.2 (SD 9.3) years.

**Measures**

Since the goal of the study was to assess the incidence, severity, and course of depressive and anxiety symptoms reported by the patients themselves (not depressive disorder or anxiety disorder), psychiatric examination and diagnoses were not planned. Thus, authors did not evaluate clinical depression, which could be assessed by a standardized clinical interview, but evaluated depressive symptoms, which are widely measured in research studies with standardized psychometric self-report scales.

The Spielberger State-Trait Anxiety Questionnaire (STAI) and 21-item Beck Depression Inventory (BDI), including two subscales, were used [12]. STAI is a widely used, highly reliable, and valid instrument for measuring anxiety in adults and differentiates between the condition of ‘state anxiety’, with anxiety symptoms occurring in a particular period of time, and more general and long-standing ‘trait anxiety’, which is rather stable in time and is a personality trait with a tendency to react with fear. The scale consists of 20 statements about feeling, for which respondents indicated on a four-point Likert scale (from 1 to 4) how frequently they experienced the particular symptom. Representative items include ‘I feel nervous’ and ‘I feel worried’. Scores range from 20 to 80, with higher scores indicating greater anxiety.

BDI consists of 21 items, which reflect cognitive-affective and behavioral-somatic symptoms of depression, including specific alteration in mood associated with self-reproach and self-blame, regressive and self-punitive wishes, vegetative changes, and changes in activity level. Response statements are rated on a four-point scale ranging from 0 to 3 in terms of severity. The total score range is 0–63.

In addition, the structured questionnaire includes two five-item self-rating scales to assess the patient’s physical and mental health:

1. self-reported mental well-being Likert scale (from 1 = very bad to 5 = very good)
2. self-reported physical well-being Likert scale (from 1 = very bad to 5 = very good).

Moreover, clinical factors of each patient – myocardial infarctions, number of other serious somatic diseases, NYHA class, number of distal coronary anastomoses, aorta cross-clumping time (min), extracorporeal circulation time (min), intubation time (h), ICU stay (days), hospitalization after operation (days), major postoperative complications/intra-operative myocardial infarction, wound infection, application of intra-aortic balloon pump, neurologic complications (number), current somatic complaints (number), and cardiac re-hospitalization were taken into account. In addition, sociodemographic factors such as age, gender, marital status (married, widowed, and single), education (elementary, secondary, and high level) and work (active, disabled, retired, and unemployed) were analyzed.

The sample was divided by BDI level at baseline (before CABG) into depressed or non-depressed subgroups using at least 11 cut-off points at BDI affective subscale followed by Beck et al. [12]. In the case of anxiety traits in some analyses, 46 cut-off points were used dividing the group into high and low anxiety traits.

**Statistical analyses**

Regression analysis was constructed to examine the relation of a dependent variable to specified independent variables (demographic, surgical, and clinical), confirming appropriateness of fit by including $R^2$ and analysis of variance (ANOVA) table and Fisher’s least significant difference test (LSD) test, and confirming statistical significance by an F-test of the overall fit, followed by
t-tests of individual parameters. The linear regression equation was considered.

RESULTS

During the 8-year follow-up after CABG, it was established that seven patients died and nine patients did not respond. All patients died for somatic reasons. There were no incidences of suicide reported. Thus, the evaluated population was divided into three groups: respond (n = 37), deceased (n = 7), and non-respond (n = 9).

There were no differences concerning sociodemographical and clinical (including surgical ones) factors as well as mental and physical well-being before operation among the groups. However, significantly more postoperative complications and lower physical and mental well-being were noticed among patients who died later on (between T3 and T4) than those who were assessed at follow-up (Table 1). Further significant observations were made: improvement of the physical well-being in T3 comparing to T2 (p = 0.0028), reduction of the BDI somatic subscale scores T1 versus T3 (p = 0.036), and T2 versus T3 (p = 0.033), as well as reduction of anxiety state T1 versus T3 (p = 0.021).

Concerning deceased patients, no improvement was observed in T2 and T3, and the number of persons with pessimistic attitude toward the future was higher in this group as opposed to the responding and non-responding groups. Immediately after CABG, a threefold growth of pessimism was noticed (from 14% to 42%) and after 3 months as well (57%).

After 8 years from CABG, there were 68% males and 30% working persons in the response group (n = 11, 10 men). Among the 26 non-working patients, 54% were disabled, 42% retired and 1 person unemployed (4%). Seventy-eight percent were in regular contact with a cardiologist. Nobody was treated by a psychiatrist; however, 22% of them took psychiatric drugs (anti-depressive, sedative drugs) prescribed by a general practitioner.

### Depressive symptoms

The response group had mean BDI scores of 11.5 (±9.5) 8 years after CABG. Over 37.8% of the response group had total BDI scores of at least 13, which indicates depression. The mean total BDI score did not change significantly with time (p = 0.33). Similarly, mean BDI affective subscale scores were stable within all four assessments (p = 0.48) (Table 2). However, considering depressive and non-depressive subgroups divided at baseline, significant changes in the severity of symptoms were observed (Fig. 1). In the depressed subgroup, there were significant reductions of symptoms between measurements just after CABG (T2) and during follow-up (T4) (p = 0.03). In the non-depressed subgroup, there were significant reductions of symptoms between measurement before CABG (T1) and after 3 months (T3) (p = 0.03), and significant increases between 3 months (T3) and at follow-up (T4) (p = 0.04).

Nevertheless, generally non-depressed patients remained free from psychological pathology further on, whereas depressed patients were still suffering, even 8 years after operation.

Where regression analyses were concerned, anxiety state at T4 (50%), time of intubation (15%), and time of hospitalization

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### Table 1: Comparison of sociodemographic, surgical and clinical variables and self-reported scales in respond, deceased and non-respond groups before and after CABG

| Age at operation time mean (±SD) | 58.2 (±9.3) | 60.6 (±7.7) | 58.1 (±8.5) | 0.81 |
| Gender(%) | 68% males | 100% males | 56% males | 0.14 |
| Marital status at operation time (married, widowed, single) | 86%, 14%, 0% | 100%, 0%, 0% | 89%, 0%, 11% | 0.13 |
| Education (elementary, secondary and high level) | 54%, 24%, 22% | 58%, 0%, 43% | 66%, 33%, 0% | 0.38 |
| Work at operation time (active, disabled, retired, unemployed) | 30%, 38%, 30%, 2% | 29%, 43%, 28%, 0% | 22%, 45%, 33%, 0% | 1.00 |
| NYHA level median (1st Qu-3rd Qu) | 2.0 (2.0–2.0) | 2.0 (2.0–2.25) | 2.5 (2.0–2.5) | 0.15 |
| Number of heart infarcts (0, 1, 2) | 43%, 49%, 8% | 14%, 86%, 0% | 22%, 56%, 22% | 0.22 |
| Number of other serious somatic diseases (no/yes) | 76%, 24% | 71%, 29% | 44%, 56% | 0.19 |
| Number of bypasses (2, 3, 4) | 35%, 43%, 22% | 29%, 57%, 14% | 56%, 44%, 0% | 0.52 |
| Aorta clamping time [min] median (1st Qu-3rd Qu) | 41.0 (38.0–56.0) | 39.0 (35.5–46.0) | 35.0 (31.0–40.0) | 0.12 |
| Extra corporeal circulation time [min] median (1st Qu-3rd Qu) | 77.0 (68.0–97.0) | 82.0 (72.5–99.5) | 74.0 (67.0–77.0) | 0.54 |
| Intubation time (h) median (1st Qu-3rd Qu) | 17.0 (12.0–21.0) | 19.0 (16.5–19.5) | 16.0 (11.0–19.0) | 0.63 |
| Hospitalization after operation [days] median (1st Qu-3rd Qu) | 1.0 (1.0–2.0) | 1.00 (1.0–2.0) | 1.0 (1.0–1.0) | 0.45 |
| Postoperative complications median (1st Qu-3rd Qu) respond/died (p = 0.011) | 0.0 (0.0–1.0) | 1.0 (1.0–2.0) | 0.0 (0.0–0.0) | 0.019 |
| Physical well-being before CABG median (1st Qu-3rd Qu) | 3.0 (2.5–3.5) | 3.0 (2.5–4.0) | 3.0 (2.0–3.0) | 0.48 |
| Physical well-being after CABG median (1st Qu-3rd Qu) respond/died (p = 0.025) | 3.0 (2.5–3.5) | 2.0 (2.0–2.8) | 3.0 (3.0–4.0) | 0.015 |
| Mental well-being before CABG median (1st Qu-3rd Qu) | 4.0 (3.5–4.0) | 4.0 (3.0–4.0) | 3.5 (3.0–4.0) | 0.59 |
| Mental well-being after CABG median (1st Qu-3rd Qu) respond/died (p = 0.0039) | 4.0 (3.0–4.0) | 3.0 (2.0–3.0) | 4.0 (3.0–4.0) | 0.009 |
| BDI before CABG median (1st Qu-3rd Qu) | 11.0 (7.0–17.0) | 9.0 (4.0–24.0) | 16.0 (9.0–23.0) | 0.69 |
| BDI after CABG median (1st Qu-3rd Qu) | 7.0 (4.0–19.0) | 16.0 (8.0–20.5) | 14.0 (5.0–22.0) | 0.86 |
| BDI somatic subscale after 3 months median (1st Qu-3rd Qu) respond/died (p = 0.025) | 4.0 (2.0–8.0) | 9.0 (7.5–9.5) | 3.0 (2.0–7.0) | 0.079 |
| Anxiety trait mean (±SD) | 42.9 (±8.7) | 42.4 (±7.4) | 45.0 (±8.7) | 0.78 |
| Anxiety stay before CABG mean (±SD) | 44.3 (12.0) | 46.1 (12.4) | 44.4 (14.3) | 0.9 |
| Anxiety stay after CABG mean (±SD) | 41.2 (14.7) | 46.2 (12.1) | 38.7 (10.2) | 0.61 |
| Pessimistic attitude before CABG | 5% | 14% | 22% | 0.001 |
| Pessimistic attitude after CABG | 3% | 42% | 0% | 0.001 |
had major prognostic value relating to depressive symptoms 8 years after CABG and explained 75% of variance.

Anxiety symptoms

The mean anxiety trait score was 42.9 (±8.70) and 41% of patients had higher levels of anxiety trait. Significant gender differences were observed, with lower scores in males than females (40.8 ±4.9 vs 47.3 ± 8.9; \( p = 0.04 \)). The anxiety trait was negatively correlated with mental well-being at T4 (cor = -0.414; \( p = 0.01 \)).

The mean anxiety state score before CABG was 38.4 (±11.6). No gender differences were observed in anxiety state scores. After the operation (3 months and 8 years), a significant reduction of anxiety symptoms was observed (T1 vs T3; \( p = 0.02 \) and T1 vs T4; \( p = 0.01 \)) (Table 2). Anxiety state was negatively correlated with physical (cor = -0.542; \( p = 0.0005 \)) and mental well-being (cor = -0.661; \( p < 0.0001 \)) and positively with depressive symptoms (cor = 0.782; \( p < 0.0001 \)) and somatic complaints (cor = 0.522; \( p = 0.0009 \)). Major prognostic value relating to anxiety state at T4 had mental well-being at T4 (37%), BDI affective subscale (18%), employment (13%), and somatic complaints (7%), which altogether explained 76.3% of variance.

DISCUSSION

The findings of this study indicate the stability of the level of depression (affective manifestations and the total BDI result) in patients undergoing CABG. Moreover, good results of the surgical procedure did not cause the reduction of the depressive symptoms. Stroobant and Vingerhoets described similar results [3]. The absence of substantial changes in increasing the depressive symptoms 6 months and 3–5 years after surgery has been demonstrated in their investigation. According to Schrader et al., over half of the patients referred to CABG and presenting depressive manifestations on admission also suffered from them 3 and 12 months after the procedure [13]. The high general BDI score was associated with physical discomfort in the investigated group of patients. Affective and somatic symptoms resulted in high total BDI value. Somatic state related to the undergone treatment can elevate the BDI indicator independently from depression. Therefore, some authors suggest that somatic observation should be excluded from the BDI calculation. On the other hand, depressive patients, being more sensitive, can be less resistant to somatovegetative manifestations.

In contrast to depressive manifestations, anxiety states in CABG patients seem to decrease with time. The considerable reduction of anxiety in our study occurred 3 months and 8 years after the operation. The change was statistically significant after 3 months. The further decrease that was observed after 8 years was no longer unambiguous. These results correspond with the findings of other investigators [2,3,11]. Stroobant and Vingerhoets noticed the essential decrease of anxiety 6 days after the procedure [3]. The level of preoperative anxiety was significantly higher in comparison to the observations 6 days, 6 months, and 3–5 years after surgery. There were no important differences between day 6 and other time points. However, some authors emphasized the correlation between high STAI score and poor long-time prognosis after CABG procedure [10,14].

Depressive symptoms were correlated with anxiety at any time point. The coexistence of these two psychical pathologies

### Table 2: Total and subscales BDI scores and anxiety state scores in all four measure points \((n = 37)\)

<table>
<thead>
<tr>
<th></th>
<th>Total BDI median ((1\text{st Qu–}3\text{rd Qu}))</th>
<th>Affective BDI subscale median ((1\text{st Qu–}3\text{rd Qu}))</th>
<th>Somatic BDI subscale median ((1\text{st Qu–}3\text{rd Qu}))</th>
<th>Anxiety state (STAI) mean ((SD))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before CABG</td>
<td>11.0 (7.0–17.0)</td>
<td>6.0 (3.0–9.0)</td>
<td>6.0 (4.0–8.0)</td>
<td>44.3 (12.0)</td>
</tr>
<tr>
<td>After CABG</td>
<td>7.0 (4.0–19.0)</td>
<td>3.0 (1.0–10.0)</td>
<td>6.0 (3.0–11.0)</td>
<td>41.2 (14.7)</td>
</tr>
<tr>
<td>After 3 months</td>
<td>8.0 (3.0–16.0)</td>
<td>4.0 (0.0–8.0)</td>
<td>4.0 (2.0–8.0)</td>
<td>38.7 (10.6)</td>
</tr>
<tr>
<td>After 8 years</td>
<td>8.0 (5.0–16.0)</td>
<td>3.0 (1.0–10.0)</td>
<td>5.0 (3.0–8.0)</td>
<td>38.4 (11.6)</td>
</tr>
</tbody>
</table>

Figure 1: Depression scores (BDI) within four measure points in non-depressed (A) and depressed (B) patients at baseline (before CABG).
has been confirmed by other authors [3,10,11]. Based on the findings, the level of depressive symptoms was stable in an 8-year period, and anxiety symptoms were fluent perioperatively. Depressive symptoms became the basic problem for the patients during the development of CHD. The relationship between depression and cardiovascular diseases is well documented. Frasure-Smith and Lesperance [15] analyzed the results of 143 studies by stating that depression or depressive symptoms are associated with the subsequent development of coronary heart disease and increased risk of myocardial infarction. It has also been stated that the presence of diseases of the cardiovascular system often precedes the first occurrence of depressive symptoms [16,17]. Individuals with mood disorders in the face of danger (e.g., operation) respond with a high intensity of anxiety symptoms. When the immediate danger passes, anxiety drops to pre-surgery levels. However, it still remains at a higher level compared to patients without depression. Hence, there is a strong correlation of both disorders at each measurement point.

Baker et al. demonstrated that preoperative depression increases the 30-day postoperative mortality [6]. This observation has also been confirmed by other studies [18]. The persistence of depressive manifestations is a remarkable risk factor, which can deteriorate the cooperation from the patient and generate medical and economic costs [2,19]. It should also be stressed that the main objective of CABG (beyond the lengthening of life) is a sustained improvement of its quality. The presence of severe mood disorders both before and after surgery calls into question the effectiveness of such specialized and expensive medical procedures as coronary artery bypass grafting. Therefore, the authors argue that the assessment of the level of preoperative depression is important for identifying the postoperative risk group. Precise diagnosis during the perioperative period and selection of the risk group could make it possible to undertake early and appropriate psychological support and medical care.

Extensive and more detailed discussion on the results of our studies is limited by the relatively low number of prospective analyses in this field. The majority of available papers regarding anxiety and depression in CABG patients compare the preoperative state with midterm results. Under these circumstances, our data contain an important message focused on chronic, long-lasting depressive symptoms affecting patients. Interesting observations can be raised by comparing the results of responding and deceased groups. Immediately after the operation all parameters of subjective evaluation of physical and mental health in the respond group improved or remained at the same level (in relation to the preoperative state) and in the deceased group were deteriorated. The small sample size prevents the execution of reliable statistical analysis and is a big limitation of the study. Nevertheless, the present results are an inspiration for further research. The high-risk patients group will be identified shortly after surgery and specialised care will be provided.

CONCLUSIONS

It was found that depressive and anxiety symptoms occurred in many cardiosurgical patients before and after CABG; however, somatic depressive symptoms prevailed, which is important from a clinical point of view. Postoperative complications, lower physical and mental well-being, somatic symptoms, and negative life attitude were connected to bad prognosis several years after surgery. Positive cardiac effects of CABG did not influence the reduction of depressive symptoms over the short and long term. Preoperative assessment of depressive and anxiety symptoms can indicate the risk group and suggest care procedures during the rehabilitation period to improve the effectiveness of surgical coronary revascularization.

Conflict of interest: none declared.

REFERENCES