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# Hospital Anxiety and Depression Scale in patients undergoing extracorporeal circulation: an Italian cross-sectional study

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**Abstract**

Globally, cardiovascular diseases (CVDs) are the major leading cause of death. Medical literature shows an association between CVDs and depressive symptoms, anxiety, low social support, and optimism. Also, cardiac surgery, even if the progress in extracorporeal circulation (ECC) ensures the patient's recovery "*ad integrum*", can provoke strong emotional processes, including states of anxiety and fear, leading to true depression disorders. The aim of this study is to identify the degree of anxiety and depression detected by means of the validated Hospital Anxiety and Depression Scale (HADS) following cardiac surgery with ECC. This is a single-center, cross-sectional, observational study that was conducted from 26/04/2023 to 23/10/2024. It involved patients who had undergone ECC for several reasons (coronary bypass, valve replacement, aortic root and arch replacement, trans-apical transcatheter aortic valve implantation) at Marche's Polytechnic University Hospital, who were subsequently admitted to the Rehabilitation Cardiology Unit of the "Madonna del Soccorso" Hospital in San Benedetto del Tronto. The study procedure involved the administration of the HADS questionnaire by a registered psychologist. We enrolled 100 patients with an average age of 71±4 years, predominantly male (64%) rather than female (35%). The results show that at the first administration of the HADS scale questionnaire (T0), the overall mean score is 14.54±5.86. In detail, the first subscale relating to anxiety reveals a mean value of 7.18±3.54, while the second subscale relating to depression shows a mean value of 7.36±3.09. At the second administration of the HADS scale questionnaire (T1), after a medium time interval of 22 days, the overall mean score is 4.09±4.11. In detail, the first subscale relating to anxiety reveals a mean value of 2.03±2.25, while the second subscale relating to depression shows a mean value of 2.87±2.39. A two-tailed test (*t*-test) was performed and showed a significant reduction of HADS values between the first (T0) and the second (T1) questionnaire administration [$p<0.05$ (df=99) (*t*-stat=25)]. The study shows a significant reduction of anxiety and depressive status in patients who underwent ECC and were subsequently admitted to a short-term psycho-educational intervention by a registered psychologist included in a multi-professional team of a Rehabilitation Cardiology Unit.

**Key words:** extracorporeal circulation, psychological distress, cardiovascular disease, anxiety, depression, cardiac rehabilitation.

## Introduction

Globally, Cardiovascular diseases (CVDs) are the leading cause of death and contribute to worsening of health condition and excess of health systems costs [1-3]. CVDs are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease and other conditions. More than half a billion people around the world are affected by cardiovascular diseases, which accounted for 20.5 million deaths in 2021, close to a third of all deaths globally and with an overall increase up to estimated 121 million CVD deaths per year in 2050 [4]. Despite the etiopathogenicity of CVD is not entirely clear, risk factors such as age, gender, obesity, diabetes, high cholesterol, high blood pressure, and unhealthy living habits like smoking, could explain about 50–60% of the etiology of CVD [5,6].

Actually, the relationship between acute CV events and psychological disease has attracted increasing academic attention in cardiovascular medicine [7,8]. In fact, psychosocial factors have been found to be associated with an increased risk for coronary artery disease, progression and worse clinical outcome; these include depressive symptoms, anxiety, hostility, low social support and low optimism [9-11]. According to position papers of the American Heart Association and the European Society of Cardiology, depression may be a modifiable prognostic factor for developing cardiovascular diseases [12]. Apart from those, it has been reported that depression, and even more major depression, as an independent risk factor, can lead to a substantially increased risk of Coronary Heart Disease (CHD), as it not only diminished the quality of life in patients with CHD, but also increased the occurrence rate of main adverse cardiac events [13-15]. In cardiac surgery, the progresses of extracorporeal circulation (ECC) promotes the patient's metabolic recovery ad integrum but it can evoke a strong emotional status in the patients. These include states of anxiety and fear up to anxiety disorders and depression [16-18]. The aim of this study is to identify the degree of anxiety and depression detected by means of the validated HADS questionnaire, following cardiac surgery with extracorporeal circulation (ECC).

## Materials and Methods

The study is single-center cross-sectional observational investigation and was conducted in the period from 26 april 2023 to 23 october 2024. The study involved patients undergone extracorporeal circulation (for coronary bypass, valve replacement, TAVI, ascending and aortic arch replacement) at Cardiac Surgery Unit of Marche's Polithechnic University Hospital (Ancona, Marche Region, Italy) and who were admitted to the Rehabilitation Cardiology Unit of "Madonna del Soccorso" Hospital in San Benedetto del Tronto (Marche Region, Italy).

Inclusion criteria included both sexes, 18 years of age or older who expressed consent to participate to the study. Patients not undergone extracorporeal circulation were excluded from the investigation. The study procedure includes the administration of the Hospital Anxiety and Depression Scale (HADS) questionnaire by a registered psychologist at two different timings (T0 and T1) [19]. The T0 questionnaire is administered upon the patient's admission to the ward while the T1 questionnaire is administered at the discharge from the rehabilitation program (after seven weeks).

The rehabilitation program included a psychological intervention by a registered psychologist consisting of educational lessons, group and individual meetings along seven weeks.

The HADS rating scale is a validated 14-item questionnaire on a 4-point likert scale related to symptoms of anxiety and depression reactive to an organic illness. Specifically, the 14 items are divided equally over two interspersed subscales. The first-one assesses anxiety component: states of tension, nervousness, fear, worry, inability to relax, restlessness, panic attacks (odd-numbered items 1, 3, 5, 7, 9, 11 and 13). The second-one assesses the depression component: low mood, sense of slowing down, anhedonia, loss of interest in self-care, pessimism (even-numbered items 2, 4, 6, 8, 10, 12, 14). For each question, the patient should indicate which option best indicates the current level of his or her emotional state by including a single response from 0 to 3. The total score is obtained by summing the scores of the relevant items, thus obtaining a range between 0 and 21. With reference to cut-off values, “mild symptoms” are defined as scores between 8 and 10, “moderate symptoms” as between 11 and 15, and “severe symptoms” as 16 or higher. The questionnaire is an easy and short administration tool, with a time of use ranging from 2 to 5 minutes. The total score of the two scales is a valid measure of emotional stress. The usefulness of this psychometric scale is to identify potential patients with mood disorders (score above 11 on each scale) to be referred for early psychological counselling and/or to be considered for psychiatric evaluation.

### *Data collection*

The Data Protection Act and the Helsinki Declaration’s principles were followed in the study. All partecipants in the study provided their informed consent.

### *Statistical analysis*

Descriptive statistical analysis was performed, calculating standard deviations and means for the quantitative variables. Results were expressed as mean and min, medium and max range, as appropriate. To identify the significance of the reduction in emotional disturbances, a

paired-samples t-test was conducted. All the data were collected and processed by Microsoft-Excel®.

**Results**

During an enrolment period of one year, were recruited 100 patients. As we said before, the entire sample came from a recent extra-corporeal circulation (ECC) for several types of interventions.

The sample has an average age of 71 ±9 years and the gender was male for 64% and female for 35%.

The results show that at the first administration of the HADS questionnaire, called T0, the overall mean score is 14.54±5.86. In detail, the first subscale relating to anxiety reveals a mean value of 7.18±3.54 while the second subscale relating to depression shows a mean value of 7.36±3.09. At T0 administration of the questionnaire the 26% of the sample reveal "mild symptoms", 33% "moderate symptoms" and 41% "severe symptoms".

The average time interval between the two administrations of the questionnaire was 22 days.

At the second administration of the questionnaire after rehabilitation program, called T1, the overall mean score is reduced to 4.09±4.11. In detail, the first subscale relating to anxiety reveals a mean value of 2.03±2.25 while the second subscale relating to depression shows a mean value of 2.87±2.39. At the T1 administration, 84% of the sample reveal "mild symptoms", 3% "moderate symptoms" and 5% "severe symptoms". A two-tailed test (t-Test) was performed which showed a significant reduction (Figure 1) between the first and the second variables with $p<0.05$ for HADS mean values, $p<0.04$ for anxiety subscale values and $p<0.05$ for depression subscale values (df=99) (tStat=25).

**Discussion**

Over the last three decades, studies have reported disabling cerebral consequences after open-heart surgery [8,16-20]. These findings have led to an increased and multidisciplinary concern over the patient's quality of life. Recent published works show that the proportion of patients suffering from short- term neuropsychological morbidity following open- heart surgery ranges between 5.6 and 90% [11,12].

Vingerhoets reported that an important proportion of the cognitive impairment after cardiac surgery is likely to be due to non-specific effects of surgery [19].

To date, there is lack of data about the effectiveness of a psycological intervention in these types of patients referred to Cardiac Rehabilitation Units after cardiac surgery.

We proposed this observational study with the aim to investigate if a psychological intervention could be effective in this setting of patients. We assumed that HADS, first published in 1983 [19], is a good tool to assess psychological status of patients after open cardiac surgery.

Our data revealed a significant reduction of the HADS values over the time span from T0 to T1. In fact, the overall mean score at time 0 of scale administration can be considered 'moderate' (14.54±5.86). This scale provides further analyses with respect to the patient's main emotional outcomes, namely anxiety and depression. With regard to the first subscale, relating to anxiety, the mean score agreed with the HADS overall score, being moderate (7.18±3.54). In the same way, with regard to the second subscale, relating to depression, it seemed to be moderate as well (7.36±3.09).

It is interesting to note that, after 22 days of a cardiac rehabilitation program including a psychological support (T1), the HADS overall mean score became "mild" (4.09±4.11). Similar to the first administration, we applied to the two subscales: anxiety and depression. Specifically, at the T1 administration, the score relating to anxiety and depression appeared significantly reduced (2.03±2.25 and 2.87±2.39 respectively) both becoming "mild" (Figure 2).

These data support the concept that the psychological support, included in a cardiac rehabilitation program, is able in reducing the patient's anxiety and depression levels at a short-term follow-up.

Considering medical literature on the topic, several studies report that short-term psychological therapies, in particular transactional analysis, lead to a reduction in depressive symptoms [21,22]. For this reason, the American Heart Association has suggested the use of a screening questionnaire for depression in all patients with cardiovascular disease [23], but unfortunately, it is considered a time-consuming procedure and, in many hospitals, it has not yet been implemented.

In 2003, Sommaruga M. et al. published some Italian guidelines on this topic [24]. Our study represents a valid attempt to apply to them during a cardiac rehabilitation program. We believe that an optimal cardiac rehabilitation program should include psychological and psycho-educational interventions finalized to support patients and their families. This study not only confirmed the strong association between anxiety, depression, perceived distress and cardiovascular risk [25], but demonstrated that it is possible even if an optimal expertise is requested in order to correctly recognize an anxious/depressive status. From this recognition it is possible to implement a psycho-educational intervention able in restoring a good integration of patients into the daily social life.

Therefore, cardiac rehabilitation programs, usually involving a multi-professional team consisting of cardiologist, general practitioner, psychologist, nurse and physiotherapist are a good context to launching future research on the topic.

***Limitations***

However, the study has some limitations, mainly related to the methodology.

Firstly, there is no evidence of psychiatric comorbidity at T0. The lack of this information would influence the HADS outcome at T1, resulting in a selective bias. Secondly, the sample is heterogeneous in the clinical course with a various spectrum of complications and duration of hospitalization. All these variables might have influenced the psycological status. Finally, the examined sample is too small.

**Conclusions**

The reported observational study demonstrates the effectiveness of a psychoeducational intervention as part of cardiac rehabilitation program performed by a multi-professional team on the anxious and depressive status of the patients undergone extra-corporeal circulation for several types of open cardiac surgery. Given the incidence of psychological disorders in cardiac patients undergone extra-corporeal circulation, the study is helpful in spreading recent scientific knowledges in this area and to promoting the inclusion of psychologists into cardio-rehabilitation multidisciplinary team.

In conclusion, the data here reported, highlight the importance of patho-psychological outcomes into the more extensive concept of good quality of life in cardiac patient undergone cardiac surgery.

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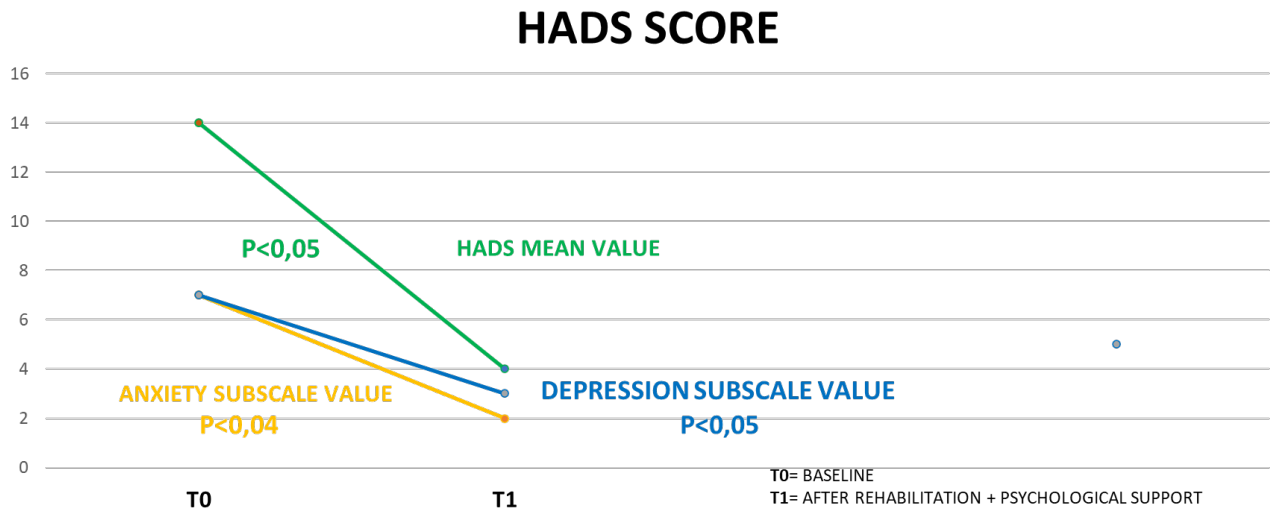


**Figure 1. HADS mean values (including anxiety and depression subscales) at T0 and T1.**

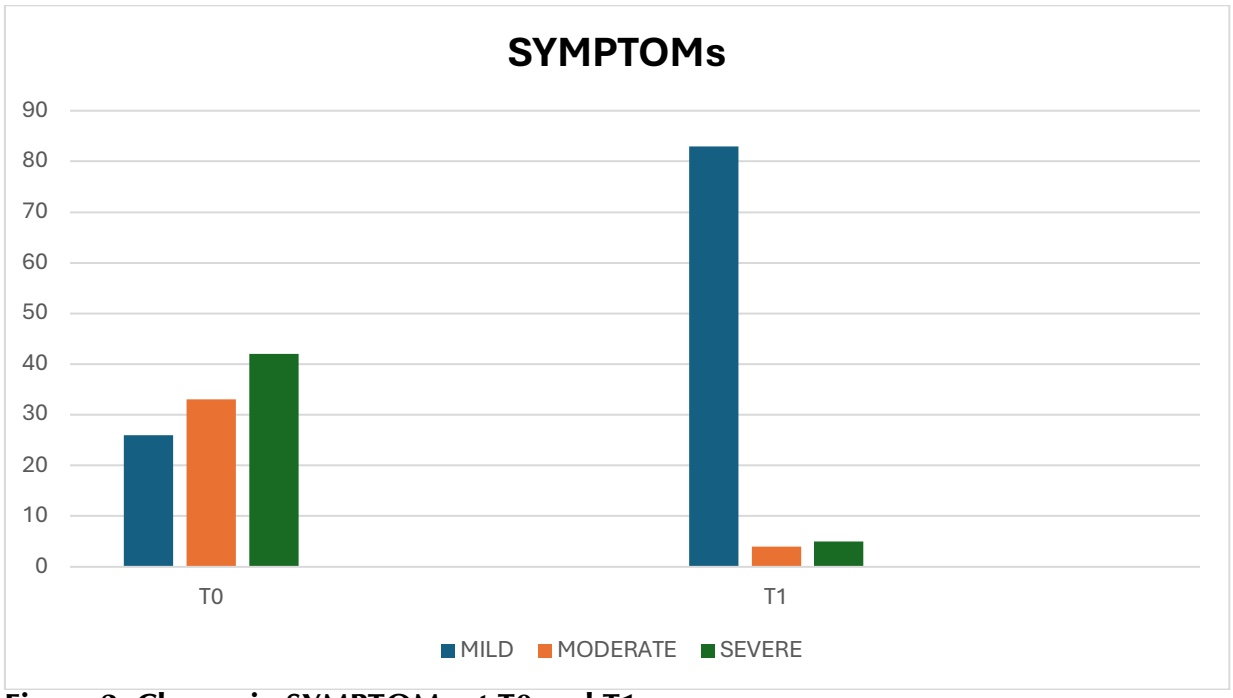


**Figure 2. Change in SYMPTOMs at T0 and T1.**