Journal of The Cardiovascular Thoracic Anaesthesia and Intensive Care Society

GKDA Derg 2023;29(2):74-79
DOI: 10.14744/GKDAD.2023.83723

RESEARCH ARTICLE

Effect of Emotional Status on Early Morbidity after Coronary Artery Bypass Graft Surgery

Alper Can,[1] Günseli Abay[2]

[1]Department of Anesthesiology, Datça State Hospital, Muğla, Türkiye
[2]Department of Anesthesiology, Dr. Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital, İstanbul, Türkiye

ABSTRACT

Objectives: We investigated whether anxiety and/or depression increased the risk of morbidity in the early postoperative period following coronary artery bypass graft surgery (CABG). Additionally, we evaluated the effects of emotional state on recovery.

Methods: We studied 81 patients undergoing CABG. Their emotional status was measured using the Hospital Anxiety and Depression Scale (HADS), Hamilton Anxiety Rating Scale, and Hamilton Depression Rating Scale on the day before surgery and on day 5 after surgery. Then, we compared the rate of postoperative cardiac, respiratory, neurological, and renal complications between the patients with mild to moderate anxiety and/or depression symptoms with those who showed no emotional distress.

Results: Prior to surgery, 18 patients showed mild to moderate anxiety and/or depression symptoms (emotional disorder group1), while the remainder (group 2, n=63) showed no emotional disorder. There was no significant difference between the preoperative and postoperative periods in both groups for all anxiety and depression test scales except for the HADS anxiety subgroup, where the results in both groups were significantly lower postoperatively than preoperatively. In the group with preoperative emotional distress, the incidence of postoperative atelectasis and pneumonia was higher than in the group with no preoperative emotional distress. Furthermore, the duration of mechanical ventilation, stay in the intensive care unit stay, and overall hospital stay was significantly longer in the emotional disorder group.

Conclusion: Emotional distress is an important risk factor that increases morbidity and delays the recovery period by increasing respiratory complications in the early postoperative period following CABG.

Keywords: Anxiety, coronary artery bypass graft surgery, depression, emotional distress, morbidity

Please cite this article as: "Can A, Abay G. Effect of Emotional Status on Early Morbidity after Coronary Artery Bypass Graft Surgery. GKDA Derg 2023;29(2):74-79".

Introduction

The incidence rate of anxiety and/or depression in patients with coronary artery disease (CAD) who are candidates for coronary artery bypass graft surgery (CABG) is 20%–45%.[1] The correlation between the presence of emotional disorders, such as depression, anxiety, or a combination thereof, and adverse outcomes after cardiac surgery was first reported in the 1960s[2] and by other investigators thereafter.[3,4] Depression has been shown to increase morbidity and mortality rates in patients with congestive heart failure[5] and CAD.[6] Furthermore, depression has been associated with increased morbidity and mortality after CABG, and even mild depression has been closely associated with increased risks of morbidity and mortality.[7–9]

Since the majority of studies investigating these correlations have focused on long-term outcomes, there is a relative scarcity of information on the effects of emotional disorders in the early postoperative period.To address this gap, we used several neuropsychiatric measurement tools to determine the effects of preoperative emotional disorders on postoperative recovery and early morbidity and mortality in a group of patients undergoing CABG.

Address for correspondence: Günseli Abay, MD. Dr. Siyami Ersek Göğüs Kalp ve Damar Cerrahisi Eğitim ve Araştırma Hastanesi, Anesteziyoloji Kliniği, İstanbul, Türkiye

Phone: +90 216 372 03 19 **E-mail:** abaygunseli1@gmail.com

Submitted: May 11, 2023 **Accepted:** May 22, 2023 **Available Online:** May 30, 2023

The Cardiovascular Thoracic Anaesthesia and Intensive Care - Available online at www.gkdaybd.org

Methods

Patient Characteristics

Those in the initial study population who refused to give informed consent, were undergoing reoperation, had an ejection fraction <30%, or had severe neuropsychiatric disorders were excluded. The final study cohort comprised 81 patients (age: 39–51 years; 53 male, 28 female) with at least 8 years of education who underwent elective CABG.

A detailed medical history was obtained from each patient, including the coexistence of conditions such as hypertension, diabetes mellitus, chronic renal failure, and chronic obstructive pulmonary disease (COPD), as well as the history of cigarette and alcohol use. This was followed by a physical examination and neuropsychiatric tests. Prior to surgery, 18 patients showed mild to moderate anxiety and/or depression symptoms (emotional disorder group 1), while the remainder (group 2, n=63) showed no emotional disorder.This study was carried out in accordance with the Helsinki Declaration.Our study was conducted between January 2011 and January 2012 prospectively, after obtaining the hospital ethical committee approval number 0324 dated January 24, 2011.

Anesthetic Technique

Patients were premedicated with midazolam(Midazolam, Pfizer) and atropine sulfate 30 min before anesthesia induction and were taken to the operating theater while monitoring their vital signs. After electrocardiography (ECG), arterial oxygen saturation (SaO_2), and invasive blood pressure monitoring were initiated, anesthesia was induced propofol (Propofol 1%, Fresenius) 1 mgkg, fentanyl (Fentanyl, Jonhson & Jonhson) 10 µg/kg, and vecuronium bromur(Norcuron Merck Sharp Dohme), 0.1 mg/kg), and the patient was placed on mechanical ventilation. Then, a central venous catheter was placed through the internal jugular vein, and central venous pressure (CVP) monitoring was initiated. Anesthesia was maintained by the infusion of 8–10 µg/kg/h of fentanyl and 2 mg/kg/h of propofol.

Surgical Technique

After aortic and venous cannulations were performed upon heparinization, cardiopulmonary bypass (CPB) was commenced. The patient's body temperature was reduced to 28°C–32°C to achieve moderate hypothermia. Antegrade/retrograde cold blood cardioplegia was used for myocardial protection after aortic cross-clamping (CC). During extracorporeal circulation, CPB was maintained at 2–2.5 L/m^2/min and hematocrit between 20%–25%. Heparinization (3–4 mg/kg) was started and monitored using the activated coagulation time (ACT), which was maintained at >400 s during CPB. Blood gas analysis and ACT were performed every 30–45 min during surgery. Hemodynamic parameters, urinary output, and body temperature were also monitored. After surgery completion, CPB was terminated, resulting in a return to normothermia.

Postoperative Care

After surgery, the patients were transferred to the intensive care unit while still intubated. They were placed on mechanical ventilation and closely monitored using ECG (leads DII-V5), SaO_2, invasive blood pressure, and CVP. Extubation was performed when the patient met the appropriate criteria and if the clinical status and blood gas results allowed extubation. Early postoperative cardiac, pulmonary, renal, and neurologic complications and their outcomes were recorded.

Patients with or without preoperative anxiety and/or depression were compared in terms of early postoperative complications in addition to CPB and CC time, number of anastomoses, and the duration of surgery, mechanical ventilation, postoperative intensive care unit stay, and overall hospital stay.

Neuropsychiatric Tests

The emotional status of the patients was assessed 1 day before surgery and before the day of discharge using the Hospital Anxiety and Depression Scale (HADS), Hamilton Anxiety Scale (HAM-A), and Hamilton Depression Scale (HAM-D). Patients with scores below the cutoff value in any of the neuropsychiatric tests were included in the emotional distress group.

The HADS is a self-assessment tool that evaluates the risk of anxiety and depression and is also used to determine the level of change in these conditions. The tool has subscales for anxiety and depression and estimates the risk of depression and anxiety in subjects with physical conditions rather than making a diagnosis. It has 14 items: those with even numbers evaluate the depression domain and those with odd numbers evaluate the anxiety domain. A Likert scale is used, and each item is scored between 0 and 3. Higher scores indicate more severe anxiety and/or depression. The cutoff points for anxiety and depression subscales, as determined by Turkish adaptation studies, are 10 and 7, respectively.[10]

The HAM-D comprises 17 questions (scored between 0 and 4) that measure the severity of depression and its change. Total scores of 8–13, 14–18, and >19 indicate mild, moderate, or severe depression, respectively. The HAM-A measures psychic (six items) and somatic (eight items) anxiety and is administered by a clinician. Each item is scored between 0 and 4. Total scores of ≤5, 6–14, and ≥15 indicate no anxiety, mild to moderate anxiety, and severe anxiety, respectively.[11]

Statistical Analysis

Statistical analyses were performed using NCSS (Number Cruncher Statistical System) 2007 and PASS (Power Analysis and Sample Size) 2008 Statistical Software statistical software packages (NCSS LLC., Utah, USA). In addition to descriptive statistics (mean, standard deviation, frequency, and percentage), Student t-test and paired samples test (within-group comparisons) were used for data comparison. Qualitative data were compared using chi-square test, Yates continuity correction, and Fisher exact test. A p-value <0.05 was considered statistically significant.

Results

There was no significant difference between the two groups (with emotional disorders vs. without emotional disorders) in terms of demographic characteristics, such as age, weight, height, body surface area, and comorbidities and habits.

No significant difference was observed in operative variables, such as CPB time, aortic CC time, surgery time, and number of anastomoses, between patients with or without emotional disorders. Mechanical ventilation time and the duration of intensive care unit stay and hospital stay were significantly longer in the group of patients with emotional disorders (Table 1).

Table 2 shows the mean preoperative and postoperative test score values of the groups with and without emotional distress. The results of all psychiatric test scales showed that the mean preoperative anxiety and depression scores were significantly higher in the emotional disorder group than in the group without emotional disorders. Likewise, all test score averages in the postoperative period, except HAM-D, were higher in the emotional distress group. There was no significant difference between the preoperative and postoperative periods in both groups for all test scales except the HADS-A subgroup, where the scores were significantly lower in the postoperative period than in the preoperative period in both groups. Despite the absence of a difference between the two groups in the frequency of cardiac, renal, or neurological complications, a significantly higher proportion of patients in the emotional disorders group had respiratory complications compared with the group without emotional disorders (Table 3). Furthermore, the group with emotional disorders showed a significantly increased incidence of postoperative atelectasis, pneumonia, and readmission.

Table 1. Operative and postoperative variables

	Group 1 (n=18)	Group 2 (n=63)	p
CPB time (min)	88.22±10.35	85.70±10.40	0.366
CC time (min)	54.67±9.86	52.65±10.42	0.456
Graft number (n)	3.06±0.80	3.08±0.81	0.912
Operation time (min)	224.67±18.09	222.27±16.51	0.657
MVT (hours)	17.33±6.53	13.57±4.24	**<0.05**
Post-op stay (hours)	34.33±11.1	26.86±7.33	**<0.05**
Hospital stay (days)	11.06±2.84	8.89±1.41	**<0.01**

CPB: Cardiopulmonary bypass; CC: Cross-clamp; MVT: Mechanical ventilation time; Post-op: Postoperative unit.

Table 2. Preoperative and postoperative mean values of the HADS and Hamilton scales in the with and without emotional distress groups. Scores mean, min., max. in group 1 and group 2

	Group 1 (n=18)	Group 2 (n=63)	p
HAM-A pre-op	14 (18–10.5)	6 (4.5–8)	**0.001**
HAM-A post-op	13 (11–14.5)	6 (3.5–8)	**0.002**
p	0.873	0.785	
HAM-D pre-op	5 (3.5–8)	4 (3–6)	**0.048**
HAM-D post-op	5 (2.5–7)	5 (2.5–6)	0.225
p	0.653	0.867	
HAD-A pre-op	10 (7–11)	6 (4–8)	**0.083**
HAD-A post-op	8 (4–10)	5 (2–6)	**0.095**
p	**0.002**	**0.035**	
HAD-D pre-op	6 (3.5–8)	4 (3–6)	**0.091**
HAD-A post-op	7 (4–8.5)	4 (2–6)	**0.055**
p	0.867	0.242	

HADS: Hospital Anxiety and Depression Scale; HAM-A: Hamilton Anxiety Scale; HAM-D: Hamilton Depression Scale; HAD-A: Hospital Anxiety Depression Scale (Anxiety subscale); HAD-D: Hospital Anxiety Depression Scale (Depression subscale).

Discussion

CABG is the most widely used surgical procedure for the relief of symptoms of CAD. A high incidence of emotional disorders in candidates for cardiac surgery has prompted investigation of the association between mood disorders and postoperative morbidity and mortality. Although there is a wealth of evidence on the adverse effect of anxiety and depression on prognosis in patients with CAD, the underlying pathophysiological mechanisms remain unclear.[12] Depression has been proposed as an independent risk factor for atherosclerosis in CAD, and the presence of depressive symptoms in patients with saphenous vein grafts has been associated with an increased risk of accelerated atherosclerosis.[13,14] The literature also suggests that the poor outcome in patients with coexisting CAD and depression may be due to platelet aggregation, inflammation, and autonomic nervous system dysfunction.[15–17] Depression has been associated with oxidative stress and immune activation, which may explain the beneficial effects of statins on the risk of depression in patients with cardiovascular diseases due to their antioxidant and anti-inflammatory activities.[18] These and similar findings support the role of oxidative and inflammatory processes in depres-

Table 3. Distribution of postoperative complications

	Group 1 (n=18)		Group 2 (n=63)		p
	n	%	n	%	
Cardiac					
Hypertension	8	44.4	20	31.7	0.473
Arrhythmia	2	11.1	4	6.3	0.610
Tamponade	0	0	5	7.9	0.582
Respiratory					
Atelectasis	4	22.2	3	4.8	**0.020***
Prolonged entubation	4	22.2	2	3.2	**0.007****
Reentubation	2	11.1	1	1.6	0.123
Pneumonia	2	11.1	0	0	**0.047***
Renal					
ARF	0	0	1	1.6	1.000
Hemodialysis	1	5.6	1	1.6	0.397
Neurological					
Delirium	2	11.1	2	3.2	0.212
CVA	1	5.6	0	0	0.222
Re-admission to post-op	2	11.1	0	0	**0.047***

*: p<0.05; **: p<0.01. ARF: Acute renal failure; CVA: Cerebrovascular accident; post-op: Postoperative unit.

sion and may pave the way for the replacement of traditional antidepressants with novel therapeutic approaches based on new pathophysiological mechanisms.

A review of several studies examining preoperative determinants of postoperative depression and anxiety in patients undergoing CABG revealed that the preoperative existence of anxiety and/or depression was the most important risk factor.[19,20] Gender and age have also been associated with postoperative depression and anxiety.[19] Similarly, younger age, female gender, living alone, cigarette smoking, and obesity have emerged as important risk factors for depression and anxiety in studies examining patient characteristics and their association with the occurrence of emotional disorders after acute coronary syndrome or CABG.[19]

Based on HADS and HAM-A scores, 9/81 (11.1%) patients in our study cohort had varying degrees of preoperative anxiety. Most studies have reported a decline in anxiety following CABG .[21,22] Decreased anxiety during the early postoperative period is attributed to the relief of psychological stress and tension after the procedure. In our study, the decrease was only significant in the HADS-A subgroup (Table 2). The difference between HADS and HAM-A in terms of statistical significance may be related to their differential sensitivity due to our sample size. Therefore, larger samples may negate such a difference between the two scales.

The literature generally suggests that, as opposed to anxiety, an increase in the severity of depression during the early postoperative period may result in the persistence of high depression scores for longer periods of time, and a return to preoperative baseline scores may take many months.[22–24] In our study, 9/81 (11.1%) patients had varying degrees of preoperative depression symptoms. Although there was a slight increase in the severity of the depressive symptoms following surgery according to both neuropsychiatric assessment scales, the differences were not significant in either group.

The HADS, HAM-A, and HAM-D are widely used psychometric tools with established reliability that are used to assess depression and anxiety. Rymaszewska et al.[25] and Freeland et al.[26] used the HAM-D, whereas Stafford et al.[18] and Schulberg et al.[27] used the HADS to assess the severity of depression in their studies. Tiringer et al.[28] compared HADS, HAM-A, and HAM-D to evaluate anxiety and depression in cardiac patients. In this study, the authors concluded that HADS-A and HADS depression subscales showed a high correlation with Hamilton scales assessing the same domains and could be reliably used for the assessment of depression and anxiety. Lane et al.[29] proposed that depression could only affect mortality when it occurred in conjunction with other cardiac risk factors and that due to the challenges in ruling out individual risk factors, it might be difficult to obtain meaningful statistical results on this matter. On the other hand, Blumenthal et al.[7] suggested that depression played an independent role in increasing mortality after CABG, just as is the case for age, gender, number of grafts, history of smoking, diabetes, and left ventricular ejection fraction. Most studies supporting the role of clinical depression in increasing cardiac events following CABG had small sample sizes with short follow-up periods, jeopardizing their statistical power to detect an effect on mortality. Due to recent advances in surgical techniques and risk management strategies, another potential difficulty in determining the association between depression and mortality is the low mortality rates after CABG, which decreases the ability of statistical tests to detect an effect. Similarly, since there were no mortalities following CABG in our study cohort, we could not evaluate the association between mortality and emotional status. This association should be more comprehensively evaluated in prospective randomized control trials with much larger sample sizes and longer follow-up periods.

Our study showed significantly higher postoperative respiratory complications in subjects with emotional disorders compared with those without. This may be a reflection of the hypersensitivity/excitability of the autonomic nervous system in those with anxiety and/or panic disorder. Anxiety can negatively affect the effectiveness of breathing, causing panic and chest pain and exacerbating respirato-

ry symptoms.[30] Over the past 3 decades, we have gained a deeper understanding of the biological foundations of anxiety and panic disorder. A genetic disposition for increased autonomic nervous system activity, particularly in the noradrenergic pathways, may play an etiologic role in the development of this condition.[31]

Episodes of tachypnea, tachycardia, agitation, and sweating, which are the classical signs of severe patient-ventilator asynchrony, have been reported in patients with anxiety when weaning off mechanical ventilation. Similarly, COPD patients with anxiety and/or depression had more severe dyspnea and treatment resistance compared with those without anxiety and/or depression during acute exacerbations.[32]

An Indian study suggested that patients with emotional disorders have lower functional lung capacity and poor inspiratory muscle strength following cardiac surgery.[33] Thus, it was suggested that a preoperative psychological and physical health evaluation, including cardiopulmonary fitness, may be useful in preventing possible pulmonary complications.

Based on these data, we can say that the significantly higher incidence of atelectasis in our patients with emotional disorders may be explained by more frequent and shallow respiratory activity with smaller tidal volumes, leading to an increased incidence of airway collapse. Since patients with atelectasis fail to meet the extubation criteria, the duration of mechanical ventilation is prolonged, which may explain the longer duration of mechanical ventilation in the patients with anxiety in our study. It was reported that patients with depressive disorders were three times more likely to fail to wean off mechanical ventilation than patients without such disorders.[34] Furthermore, the patients with anxiety in our study had a significantly higher incidence of ventilator-associated pneumonia compared with those without anxiety. Prolonged mechanical ventilation and a prolonged stay in the intensive care unit have been associated with increased risks of ventilator-associated pneumonia and intensive care unit infections.[35]

Depression has been associated with a longer hospital stay.[36,37] In our study, significantly longer postoperative stays in the intensive care unit and in the hospital overall in patients with anxiety and depression were probably related to difficulties experienced in recovery and adaptation.

In conclusion, emotional disorders represent an important risk factor for increased postoperative morbidity among patients undergoing CABG that may lead to prolonged mechanical ventilation during the early postoperative period, resulting in an increased risk of respiratory complications and an increased length of overall hospital stay and intensive care unit stay.

Disclosures

Ethics Committee Approval: The study was approved by The Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital Ethics Committee (Date: 24/01/2011, No: 0324).

Informed Consent: Written informed consent was obtained from all patients.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study has received no financial support.

Authorship Contributions: Concept – G.A., A.C.; Design – G.A., A.C.; Supervision – G.A., A.C.; Data collection &/or processing – G.A., A.C.; Analysis and/or interpretation – G.A., A.C.; Literature search – G.A., A.C.; Writing – G.A., A.C.; Critical review – G.A., A.C.

References

1. Tully PJ, Baker RA. Depression, anxiety, and cardiac morbidity outcomes after coronary artery bypass surgery: A contemporary and practical review. J Geriatr Cardiol 2012;9:197–208.
2. Blachly PH, Blachly BJ. Vocational and emotional status of 263 patients after heart surgery. Circulation 1968;38:524–32.
3. Connerney I, Shapiro PA, McLaughlin JS, Bagiella E, Sloan RP. Relation between depression after coronary artery bypass surgery and 12-month outcome: A prospective study. Lancet 2001;358:1766–71.
4. Rothenhäusler HB, Grieser B, Nollert G, Reichart B, Schelling G, Kapfhammer HP. Psychiatric and psychosocial outcome of cardiac surgery with cardiopulmonary bypass: A prospective 12-month follow-up study. Gen Hosp Psychiatry 2005;27:18–28.
5. Celano CM, Villegas AC, Albanese AM, Gaggin HK, Huffman JC. Depression and anxiety in heart failure: A review. Harv Rev Psychiatry 2018;26:175–84.
6. Murphy B, Le Grande M, Alvarenga M, Worcester M, Jackson A. Anxiety and depression after a cardiac event: Prevalence and predictors. Front Psychol 2020;10:3010.
7. Blumenthal JA, Lett HS, Babyak MA, White W, Smith PK, Mark DB, et al. Depression as a risk factor for mortality after coronary artery bypass surgery. Lancet 2003;362:604–9.
8. Rafanelli C, Roncuzzi R, Milaneschi Y. Minor depression as a cardiac risk factor after coronary artery bypass surgery. Psychosomatics 2006;47:289–95.
9. Iribarne A, Chang H, Alexander JH, Gillinov AM, Moquete E, Puskas JD, et al. Readmissions after cardiac surgery: Experience of the National Institutes of Health/Canadian Institutes of Health research cardiothoracic surgical trials network. Ann Thorac Surg 2014;98:1274–80.
10. Aydemir Ö, Guvenir T, Kuey L, Kültür S. Reliability and validity of the Turkish version of hospital anxiety and depression scale. Turk J Psy 1997;8:280–7.
11. Akdemir A, Örsel SD, Dağ H, Türkçapar MH, İşcan N, Özbay H. Hamilton Depresyon derecelendirme ölçeği (HDDÖ)'nin geçerliği, güve-

nilirliği ve klinikte kullanımı. Psikiatri, Psikoloji Psikofarmokoloji Derg 1996;4:251–9.
12. Dickens C. Depression in people with coronary heart disease: Prognostic significance and mechanisms. Curr Cardiol Rep 2015;17:83.
13. Wellenius GA, Mukamal KJ, Kulshreshtha A, Asonganyi S, Mittleman MA. Depressive symptoms and the risk of atherosclerotic progression among patients with coronary artery bypass grafts. Circulation 2008;117:2313–9.
14. Goldstein BI, Carnethon MR, Matthews KA, McIntyre RS, Miller GE, Raghuveer G, et al. Major depressive disorder and bipolar disorder predispose youth to accelerated atherosclerosis and early cardiovascular disease: A scientific statement from the American Heart Association. Circulation 2015;132:965–86.
15. Brydon L, Magid K, Steptoe A. Platelets, coronary heart disease, and stress. Brain Behav Immun 2006;20:113–9.
16. Kuijpers PM, Hamulyak K, Strik JJ, Wellens HJ, Honig A. Beta-thromboglobulin and platelet factor 4 levels in post-myocardial infarction patients with major depression. Psychiatry Res 2002;109:207–10.
17. Celano CM, Daunis DJ, Lokko HN, Campbell KA, Huffman JC. Anxiety disorders and cardiovascular disease. Curr Psychiatry Rep 2016;18:101.
18. Stafford L, Berk M. The use of statins after a cardiac intervention is associated with reduced risk of subsequent depression: Proof of concept for the inflammatory and oxidative hypotheses of depression? J Clin Psychiatry 2011;72:1229–35.
19. McKenzie LH, Simpson J, Stewart M. A systematic review of pre-operative predictors of post-operative depression and anxiety in individuals who have undergone coronary artery bypass graft surgery. Psychol Health Med 2010;15:74–93.
20. Cserép Z, Losoncz E, Balog P, Szili-Török T, Husz A, Juhász B, et al. The impact of preoperative anxiety and education level on long-term mortality after cardiac surgery. J Cardiothorac Surg 2012;7:86.
21. Murphy BM, Elliott PC, Higgins RO, Le Grande MR, Worcester MU, Goble AJ, et al. Anxiety and depression after coronary artery bypass graft surgery: Most get better, some get worse. Eur J Cardiovasc Prev Rehabil 2008;15:434–40.
22. Kustrzycki W, Rymaszewska J, Malcher K, Szczepanska-Gieracha J, Biecek P. Risk factors of depressive and anxiety symptoms 8 years after coronary artery bypass grafting. Eur J Cardiothorac Surg 2012;41:302–6.
23. Korbmacher B, Ulbrich S, Dalyanoglu H, Lichtenberg A, Schipke JD, Franz M, et al. Perioperative and long-term development of anxiety and depression in CABG patients. Thorac Cardiovasc Surg 2013;61:676–81.
24. Stroobant N, Vingerhoets G. Depression, anxiety, and neuropsychological performance in coronary artery bypass graft patients: A follow-up study. Psychosomatics 2008;49:326–31.
25. Rymaszewska J, Kiejna A, Hadryś T. Depression and anxiety in coronary artery bypass grafting patients. Eur Psychiatry 2003;18:155–60.
26. Freedland KE, Skala JA, Carney RM, Rubin EH, Lustman PJ, Dávila-Román VG, et al. Treatment of depression after coronary artery bypass surgery: A randomized controlled trial. Arch Gen Psychiatry 2009;66:387–96.
27. Schulberg HC, Belnap BH, Houck PR, Mazumdar S, Reynolds CF 3rd, Rollman BL. Treating post-CABG depression with telephone-delivered collaborative care: Does patient age affect treatment and outcome? Am J Geriatr Psychiatry 2011;19:871–80.
28. Tiringer I, Simon A, Herrfurth D, Suri I, Szalai K, Veress A. Occurrence of anxiety and depression disorders after acute cardiac events during hospital rehabilitation. Application of the Hospital Anxiety and Depression Scale as a screening instrument. Psychiatr Hung [Article in Hungarian] 2008;23:430–43.
29. Lane D, Carroll D, Ring C, Beevers DG, Lip GY. Mortality and quality of life 12 months after myocardial infarction: Effects of depression and anxiety. Psychosom Med 2001;63:221–30.
30. Bordoni B, Marelli F, Bordoni G. A review of analgesic and emotive breathing: A multidisciplinary approach. J Multidiscip Healthc 2016;9:97–102.
31. Bandelow B, Baldwin D, Abelli M, Bolea-Alamanac B, Bourin M, Chamberlain SR, et al. Biological markers for anxiety disorders, OCD and PTSD: A consensus statement. Part II: Neurochemistry, neurophysiology and neurocognition. World J Biol Psychiatry 2017;18:162–214.
32. Regvat J, Žmitek A, Vegnuti M, Košnik M, Šuškovič S. Anxiety and depression during hospital treatment of exacerbation of chronic obstructive pulmonary disease. J Int Med Res 2011;39:1028–38.
33. Yuenyongchaiwat K, Buranapuntalug S, Pongpanit K, Kulchanarat C, Satdhabudha O. Anxiety and depression symptomatology related to inspiratory muscle strength and functional capacity in preoperative cardiac surgery patients: A preliminary cross-sectional study. Indian J Psychol Med 2020;42:549–54.
34. Jubran A, Lawm G, Kelly J, Duffner LA, Gungor G, Collins EG, et al. Depressive disorders during weaning from prolonged mechanical ventilation. Intensive Care Med 2010;36:828–35.
35. Hyllienmark P, Martling CR, Struwe J, Petersson J. Pathogens in the lower respiratory tract of intensive care unit patients: Impact of duration of hospital care and mechanical ventilation. Scand J Infect Dis 2012;44:444–52.
36. Contrada RJ, Boulifard DA, Hekler EB, Idler EL, Spruill TM, Labouvie EW, et al. Psychosocial factors in heart surgery: Presurgical vulnerability and postsurgical recovery. Health Psychol 2008;27:309–19.
37. AbuRuz ME. Pre-operative depression predicted longer hospital length of stay among patients undergoing coronary artery bypass graft surgery. Risk Manag Healthc Policy 2019;12:75–83.