

Depression, Functionality and Adaptability of Elderly Patients After Open Heart Surgery Off- or On-Pump

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Background: Open heart surgery is performed by two methods of off or on cardiopulmonary bypass. Both methods may affect the rate of depression, level of functionality and adaptation of the elderly undergoing the operations.

Objectives: The current study aimed to assess depression, level of functionality and adaptability in elderly patients undergoing open heart surgery with off or on pump in the in open heart surgery intensive care unit of Imam Khomeini and Shariati Hospitals, Tehran University of Medical Sciences.

Patients and Methods: This cross-sectional study was conducted from 23 September 2013 to 22 March 2014. The samples were 160 elderly patients who were selected by convenience sampling method and divided into two groups of on-and off-pump coronary artery bypass graft. The rate of depression and level of functionality of the patients were assessed before and six weeks after surgery by Geriatric Depression Scale (GDS) and Medical Outcome Study SF 12 (MOS SF-12) questionnaires respectively, in a self-reporting approach. The rate of patient's adaptability was also evaluated six weeks after the surgery by Ways of Coping Questionnaire (WOCQ).

Results: In on-and off-pump groups, there were statistically significant differences in terms of depression rate and level of functionality before and six weeks after the surgery, respectively, as ($P = 0.001$) and ($P = 0.0001$). The t-test results also showed that the patients' adaptability in the on-pump group with the mean \pm SD of 111.1 ± 56.17 was significantly different from that of the off-pump group with the average changes of 70.88 ± 91.15 ($P = 0.0001$).

Conclusions: It is recommended to further support the patients undergoing on-pump open heart surgery, and some programs will be designed to reduce the level of their depression and increase their adaptability and functionality levels.

Keywords: Adaptability; Depression; Functionality Level; On-Pump Coronary Artery Bypass; Off-Pump Coronary Artery Bypass

1. Background

According to the studies, the world population is aging. Until 2035, 13% of the world's population will be over 65 years old (1). Many factors contribute to morbidity and mortality of the aged among which the cardiovascular disease is the most common one (2). The use of invasive procedures such as Coronary Artery Bypass Grafting (CABG) is common in the elderly. CABG is the most common surgical procedure of coronary artery bypass grafting performed through on-pump and off-pump methods, and the most common method is the use of pumps (artificial heart and lung machine) (3). This operation has numerous physical and psychological side effects. With increasing age, due to reduced function of organs and underlying diseases, the complications after open heart surgery would be more in the elderly than in other age groups. One of the most common complications after cardiac surgery, especially in the elderly, is depression

(4); the rate of depression in the elderly after open heart surgery is estimated between 17.5% and 28.7% (5).

Depression in the elderly is estimated as the second leading cause of disabilities in this period after physical causes. However, post CABG depression can cause an increased risk of cardiac arrhythmias, reduced functional capacity, increased hospitalization, non-performing on treatment programs and ultimately mortality rate. The above symptoms lead to dysfunction and cognitive disorder, and thus, reduce the quality of life inpatients (6). The researches have also shown that fatigue and weakness in elderly patients after open heart surgery decreases physical activity and functionality level of the patients. Reduced functionality level, which is among common complications after open heart surgery, can reduce the patients' independence and increase their dependence on the family members and relatives (7).

Given that CABG is a stressful event, adaptability to it would be different depending on the people's assessment of a stressful event. During the initial assessment, the elderly rarely consider it as a benign and safe phenomenon. Their initial evaluation of CABG includes a feeling of danger, loss, fear, anxiety and uncertainty (8, 9). On-pump coronary artery bypass surgery is an acceptable method with low morbidity and mortality rates and an effective treatment approach for the patients with coronary problems (10). In recent years, the off-pump technique is conventional in coronary surgeries (11). However, despite the advantages of this method, such as reduced risk of stroke, bleeding, re-hospitalization and incidence of cardiac arrhythmia, most surgeries are still done off-on-pump in the coronary bypass surgery (12, 13). Due to increased life expectancy and the development of surgical techniques and considering the above mentioned and the inconsistent study's results regarding on-pump and off-pump open heart surgeries (14), the depression rate, level of functionality and adaptability of elderly patients should be evaluated and compared after open heart surgery, both in on-pump and off-pump methods, to suggest further interventional measures based on the findings.

2. Objectives

The current study aimed to assess depression, level of functionality and adaptability in elderly patients undergoing open heart surgery with off or on pump in the Open Heart Surgery Intensive Care Unit of Imam Khomeini and Shariati hospitals, Tehran University of Medical Sciences.

3. Patients and Methods

The cross-sectional study was performed from 23 September 2013 to 22 March 2014 aimed to assess depression rate, functionality and adaptability in elderly referred to the Open Heart Surgery Intensive Care Unit of Imam Khomeini and Shariati public hospitals, affiliated to Tehran University of Medical Sciences. As the number of patients in one hospital did not cover the needed sample size, two teaching hospitals similar in terms of staff, surgery procedure and referred patients were selected. After putting the values in the formula, to determine the sample size required at the 95% confidence level and testing capacity of 80%, assuming that open heart surgery leads to a change in depression rates of subjects as a minimum of $d = 1.5$, to be statistically significant, the required sample size was estimated as $N = 80$. It should be noted that based on similar studies, the SD of depression score changes before and after surgery was estimated as $SD = 4$.

$$(1) \quad n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2 \times s_d^2}{d^2}$$

Totally 160 elderly patients were selected by a convenience sampling method and randomly divided into two

groups by assigning the random number stable. There were 80 patients in the on-pump open heart surgery group and 80 patients in the off-pump group.

Inclusion criteria included elderly patients undergoing open heart surgery for the first time, with access to the phone and not having depression before the surgery according to the Geriatric Depression Scale (GDS). If the patients were hospitalized during the first six weeks after surgery for any reasons, involved with the death of a loved one or unwilling to continue the participation, they were excluded from the study. Thus, after receiving permission from the University Ethics Committee (Tehran University of Medical Sciences, No. 310), and being introduced to the research environment, the eligible subjects were selected, and written informed consent was obtained from them. Before surgery, the questionnaires regarding the level of functionality and depression rate were completed as self-reporting by the subjects. Six weeks after the surgery, through phone contact or in person (in coordination with the responsible physician while the patient referred to the clinic), the questionnaires regarding the depression rate, adaptability and functionality level were completed again.

The data collection tools were three questionnaires. For the patients' functionality, the Medical Outcome Study SF 12 (MOS SF-12) tool was used, a modified form of the SF-36 questionnaire, in which the questions were as multiple-choice Likert scale and as Yes/No answers as well. The questionnaire assesses the functional level and the quality of life in terms of the following factors:

- Overall perception of own health status (statement 1)
- Physical functioning (statements 2 and 3)
- Physical health (statements 4 and 5)
- Emotional problems (statements 6 and 7)
- Bodily pain (statement 8)
- Social functioning (statement 9)
- Vitality and life energy (statement 11)
- Mental health (statements 10 and 12)

Questions 1, 8, 10 and 11 were reversely scored. For example, score 5 in statement 1 was converted to 1, and score 1 in the same question was converted to 5. The individuals were divided into three categories based on the obtained scores from the questionnaire: Low (12 - 24), Moderate (25 - 36) and Good (37 - 48). The score range varied from 12 to 48. High scores indicate higher quality of life. The tool validity was assessed with content validity, and the test-retest method were used to determine the tool reliability ($r = 90\%$). The questionnaire was also validated among the elderly population and the Iranian society (15, 16).

The GDS tool was used to collect data on depression in patients. The questionnaire contains 15 questions and has a maximum of 15 points. Its content validity was assessed by Malakouti et al. and its reliability was evaluated and approved by Cronbach's alpha coefficient of 90% (17). To determine the severity of depression, the scores equal to 3 or less were considered as a normal condition, while between 3 and 10 and greater than 10 indicated moderate and severe depression, respectively.

The WOCQ was used to assess the patients' adaptability. The questionnaire was designed in 1980 by Folkman and Lazarus (18). It consists of 66 items rated on a four-choice Likert scale (I did not use = 0; I used a lot = 2). The questionnaire evaluates eight methods of coping that are eventually classified into two general problem-focused and emotion-focused styles. The problem-focused coping style include seeking for social support, accountability, managerial problem solving, and positive reevaluation, while the emotion-focused coping style include encountering, avoiding, self-restraint and escape-avoidance. In Iran, the validity and reliability of the tests were evaluated and reported with content validity and internal consistency with Cronbach's alpha of 0.89, respectively, by Hashemzadeh (19).

Finally, the data were analyzed using SPSS software ver. 16 through statistical tests of independent t-test and Chi-square test.

4. Results

The mean age of patients in the on-pump group was 71.5 ± 7.04 years, while it was 72.6 ± 7.1 years in the off-pump

group. Other personal profile and characteristics are given in (Table 1). Most of the patients had normal depression levels before surgery in on-pump CABG group (81.2%) and in the off-pump group (90%), which were not significantly different ($P = 0.08$). After the surgery, most patients in the on-pump group (66.3%) and in the off-pump group (96.2%) had moderate depression and statistically significant difference was observed between them ($P = 0.001$) (Table 2). Also, before the surgery, most patients in the on-pump group (92.5%) and in the off-pump group (91.2%) had a moderate level of functionality, but no significant difference was observed between the two groups ($P = 0.6$). After the surgery, patients in the on-pump (52.5%) and off-pump (88.8%) groups had also moderate functionality level; however, a statistically significant difference was observed between the two groups ($P = 0.0001$) (Table 3). Also, the independent t-test results showed a significant difference in terms of adaptability in on-pump group patients with mean changes of 111.1 ± 56.17 compared to the off-pump group patients with mean changes of 70.88 ± 91.15 ($P = 0.0001$).

Table 1. Demographic Data of Patients in Both On-Pump and Off-Pump Groups

Group Characteristic	Off-Pump ^a	On-Pump ^a	Result Test	
			χ^2	df
Gender			33	1
Male	40 (50)	42 (52.5)		
Female	40 (50)	38 (47.5)		
Level of education			0.40	3
Illiterate	16 (20)	18 (22.5)		
School	40 (50)	40 (50)		
Diploma	16 (20)	16 (20)		
University	5 (16.7)	2 (6.7)		
Marital status			0.28	1
Single	4 (5)	5 (6.2)		
Married	76 (95)	75 (93.8)		
Smoking			0.40	3
Yes	45 (56.2)	50 (62.5)		
No	23 (43.8)	25 (37.5)		

^a Frequency (%).

Table 2. Comparison of Patients' Depression Before and After Surgery both in On-Pump and Off-Pump^a

Groups	Depression			Result Test		
	Normal	Mild	Sever	χ^2	df	P
Before surgery				4.8	2	0.08
On-pump	65 (81.2)	11 (13.8)	4 (5)			
Off-pump	72 (90)	8 (10)	0			
After surgery				15.2	2	0.0001
On-pump	0	55 (66.3)	25 (33.7)			
Off-pump	2 (2.5)	77 (96.2)	1 (1.2)			

^a Values are presented as No. (%).

Table 3. Comparison of the Functionality Level of Patients Before and After Surgery Both in On-Pump and Off-Pump Groups ^a

Groups	Functionality Level			Result Test		
	Poor	Fair	Good	χ^2	df	P
Before surgery				30.7	2	0.0001
On-pump	0	74 (92.5)	6 (7.5)			
Off-pump	1 (1.2)	73 (91.2)	6 (7.5)			
After surgery				30.7	2	0.0001
On-pump	37 (46.2)	42 (52.5)	1 (1.2)			
Off-pump	6 (7.5)	71 (88.8)	3 (3.8)			

^a Values are presented as No. (%).

5. Discussion

The current study findings showed that the two groups had a normal rate of depression before the surgery. Six weeks after the surgery, most patients in both groups had a moderate depression rate. However, in the on-pump group, 25 patients had severe depression, while only one patient in the off-pump group had severe depression. Statistically, a significant difference was observed between the two groups. Also, before the surgery, most patients in both groups had a moderate level of functionality. Six weeks after the surgery, most patients in both groups had a moderate level of functionality. In the off-pump group, the number of patients was greater and a significant difference was observed between the two groups. After the surgery, the adaptability in the off-pump patients was significantly higher than the on-pump group.

Drury et al. concluded that with increasing age, the mortality rate of patients ($P = 0.04$), postoperative complications (myocardial infarction, infection, delirium, etc.) ($P < 0.001$) as well as the rate of hospitalization ($P < 0.01$) would significantly increase after open heart surgery (5). The above study recommended exploring the other side effects; where as in this study, side effects such as adaptability, depression and functionality level of the elderly population were also studied. Polomsky et al. found that the off-pump surgery reduces the rates of mortality, myocardial infarction, acute renal failure, morbidity and mortality and hospitalization compared to the on-pump operating method. Other side effects were investigated in the present study (20).

Athanasίου et al. in a systematic review concluded that the off-pump surgery method reduces the risk of neurological strokes compared with the on-pump procedure (14). The off-pump CABG method is more useful than the on-pump CABG method in patients with severe cardiovascular complications before the surgery. In this study, the need for further research was mentioned more than the present study, which compares the influence of these two surgical methods (13).

Mirzaei et al. concluded that in the off-pump surgery, the myocardial damage was lower than the on-pump method, and off-on-pump the off-pump method was a reliable method for coronary heart patients (21). Also,

Wan concluded that the patients with preoperative lower depression rate and functionality level would be similar after the surgery. Also, female patients had higher depression and poorer functionality before and after surgery compared to male patients. In this study, they defined depression and functionality level as treatable and responsive to interventions parameters and stated that if the nurse assesses the patient before surgery and makes the necessary interventions, these two factors could be improved (22). The results of the above studies are in line with those of the present study, and all confirm the more positive results and fewer side effects in the off-pump method than the on-pump method.

However, the results of the study by Suzanne showed no relationship between the type of surgery (with or without pump) and psycho-neurological disorders, and that the cardiopulmonary bypass machine cannot be the main cause of depression after surgery (23). This difference may be because they enrolled the patients with previous history of depression before the surgery in the study, while in the current study, through evaluation of patients' depression levels, the depressed ones were excluded. Therefore, it is recommended to perform further studies on patients with poor functional or some degrees of depression before the surgery to compare the two mentioned surgical methods. Also, given that in the present study, six weeks after the intervention, the depression rate, levels of functionality and adaptability of the patients were assessed, it is recommended to perform studies with longer follow-up periods.

According to the obtained results these patients need more care measures such as family support, participation in social activities and long-term nursing care after discharge due to aging and co morbidities, the nurses are responsible for taking care of the elderly after heart surgery. They need to receive important information to deal with the problems. Thus, through pre-operative education, Nurses can minimize the postoperative complications by face off-on on the patients' problems and doing nursing interventions through various forms of social support such as providing information, tangible emotional support, encouraging the patients to express their

feelings, fears and concerns. Also, given that reduced adaptability, level of function and increased severity of depression were higher in the on-pump group, with the advancement of surgical technologies and procedures and considering that most of CABG surgeries occur in the elderly, it is recommended to use the off-pump approach, if possible, to improve functionality levels and adaptability, and reduce depression.

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Authors' Contributions

Fatemeh Bahramnezhad, Parvaneh Asgari: Designing the study, performing the statistical analysis, writing the protocol and the first draft of the manuscript and managing the literature searches; Neda Mehrdad, Ahmad Ali Asadi Noughabi: Advising the study design, managing the analyses of the study and supervising the writing of the manuscript; Davood Hekmatpou, Mokhtar Mahmoudi: Advising the study design and supervising the writing of the manuscript. All authors read and approved the final manuscript.

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References

- Samanez-Larkin GR, Robertson ER, Mikels JA, Carstensen LL, Gotlib IH. Selective attention to emotion in the aging brain. *Psychol Aging*. 2009;**24**(3):519-29.
- Rodriguez-Pascual C, Paredes-Galan E, Vilches-Moraga A, Ferrero-Martinez AI, Torrente-Carballido M, Rodriguez-Artalejo F. Comprehensive geriatric assessment and 2-year mortality in elderly patients hospitalized for heart failure. *Circ Cardiovasc Qual Outcomes*. 2014;**7**(2):251-8.
- Kshetry VR, Flavin TF, Emery RW, Nicoloff DM, Arom KV, Petersen RJ. Does multivessel, off-pump coronary artery bypass reduce postoperative morbidity? *Ann Thorac Surg*. 2000;**69**(6):1725-30.
- Volpato S, Bazzano S, Fontana A, Ferrucci L, Pilotto A, M. PI-TriVeneto Study Group. Multidimensional Prognostic Index predicts mortality and length of stay during hospitalization in the older patients: a multicenter prospective study. *J Gerontol A Biol Sci Med Sci*. 2015;**70**(3):325-31.
- Drury NE, Nashef SA. Outcomes of cardiac surgery in the elderly. *Expert Rev Cardiovasc Ther*. 2006;**4**(4):535-42.
- Ettema RG, Van Koeven H, Peelen LM, Kalkman CJ, Schuurmans MJ. Preadmission interventions to prevent postoperative complications in older cardiac surgery patients: a systematic review. *Int J Nurs Stud*. 2014;**51**(2):251-60.
- Graham MM, Galbraith PD, O'Neill D, Rolfsen DB, Dando C, Norris CM. Frailty and outcome in elderly patients with acute coronary syndrome. *Can J Cardiol*. 2013;**29**(12):1610-5.
- Polonski L, Gasior M, Gierlotka M, Kalarus Z, Cieslinski A, Dubiel JS, et al. Polish Registry of Acute Coronary Syndromes (PL-ACS). Characteristics, treatments and outcomes of patients with acute coronary syndromes in Poland. *Kardiologia Pol*. 2007;**65**(8):861-72.
- Ricci M, Karamanoukian HL, Abraham R, Von Fricken K, D'Ancona G, Choi S, et al. Stroke in octogenarians undergoing coronary artery surgery with and without cardiopulmonary bypass. *Ann Thorac Surg*. 2000;**69**(5):1471-5.
- Khan NE, De Souza A, Mister R, Flather M, Clague J, Davies S, et al. A randomized comparison of off-pump and on-pump multivessel coronary-artery bypass surgery. *N Engl J Med*. 2004;**350**(1):21-8.
- Al-Ruzzeh S, Nakamura K, Athanasiou T, Modine T, George S, Yacoub M, et al. Does off-pump coronary artery bypass (OPCAB) surgery improve the outcome in high-risk patients?: a comparative study of 1398 high-risk patients. *Eur J Cardiothorac Surg*. 2003;**23**(1):50-5.
- Angelini GD, Taylor FC, Reeves BC, Ascione R. Early and mid-term outcome after off-pump and on-pump surgery in Beating Heart Against Cardioplegic Arrest Studies (BHACAS 1 and 2): a pooled analysis of two randomised controlled trials. *Lancet*. 2002;**359**(9313):1194-9.
- Edwards JH, Huang DT. Using pump for bypass surgery-on-off-on again? *Crit Care*. 2010;**14**(5):319.
- Athanasiou T, Al-Ruzzeh S, Kumar P, Crossman MC, Amrani M, Pepper JR, et al. Off-pump myocardial revascularization is associated with less incidence of stroke in elderly patients. *Ann Thorac Surg*. 2004;**77**(2):745-53.
- Montazeri A, Vahdaninia M, Mousavi SJ, Omidvari S. The Iranian version of 12-item Short Form Health Survey (SF-12): factor structure, internal consistency and construct validity. *BMC Public Health*. 2009;**9**:341.
- Resnik L, Borgia M, Ni P, Pirraglia PA, Jette A. Reliability, validity and administrative burden of the community reintegration of injured service members computer adaptive test (CRIS-CAT)". *BMC Med Res Methodol*. 2012;**12**:145.
- Malakouti SK, Fatollahi P, Mirabzadeh A, Salavati M, Zandi T. Reliability, validity and factor structure of the GDS-15 in Iranian elderly. *Int J Geriatr Psychiatry*. 2006;**21**(6):588-93.
- Folkman S, Lazarus RS. An analysis of coping in a middle-aged community sample. *J Health Soc Behav*. 1980;**21**(3):219-39.
- Hashemzadeh R. Investigation and comparison of coping styles and illogical beliefs in tollab and male students of Ghom. Allameh Tabataba'i University; 2006.
- Polonsky M, He X, O'Brien SM, Puskas JD. Outcomes of off-pump versus on-pump coronary artery bypass grafting: Impact of pre-operative risk. *J Thorac Cardiovasc Surg*. 2013;**145**(5):1193-8.
- Mirzaei A, Esfahanizadeh J, Fazlinezhad A. Comparison of coronary artery bypass graft surgery with and without pump. *J Birjand Uni Med Sci*. 2003;**10**(3):19-24.
- Wan S, Yim AP, Ng CS, Arifi AA. Systematic organ protection in coronary artery surgery with or without cardiopulmonary bypass. *J Card Surg*. 2002;**17**(6):529-35.
- Suzanne G. Objective and subjective neuropsychological impairment and the relationship to depression, in randomized CPB and off-pump patients, following heart surgery. Canada: Universite de Montreal; 2005.