Changes in Hemodynamic Index of Elderly Patients Undergoing Coronary Artery Bypass Grafting Surgery in Hospitals of Tehran in 2016

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Absrtact: However, aging is not equivalent to a disease, but the majority of elderly patients are affected by chronic diseases such as cardiovascular diseases. Since coronary artery bypass grafting surgery is as one of the main ways to treat of elderly. This study was conducted to identify changesof hemodynamic parameters of elderly patients after coronary artery bypass grafting surgery. This study is a descriptive-comparative study that was performed on 120 elderly patients who had undergone coronary artery bypass grafting surgery in hospitals of Tehran by available sampling method. Hemodynamic parameters (Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), Pulse Pressure (PP), Heartrate (HR)) were measured two days before the surgery in the morning and evening and the third and fourth days after surgery in the morning and evening. To analyze the data was used of twentieth version of SPSS 20 Software. The average age of research participants was 66/50 (± 5/79) years old and the majority were male (78/3%). SBP, DBP, MAP have been statistically significant decrease in the third and fourth days (p = 0/05) after the surgery compared to before surgery. The PP has been a significant increase on the third day but on the fourth day has not been significant difference compared to before surgery (p = 0/502). HR has been statistically significant increases in the third and fourth day after surgery. Hemodynamic parameters (SBP, DBP, PP, MAP, HR) in elderly patients after of coronary artery surgery compared to before surgery have significant changes. These changes are not only related to the acute period and paying attention to these changes is very important even after the acute period of coronary artery bypass surgery as much as period of immediately after surgery, especially in older people who are more suffering underlying medical conditions.

Key words: Hemodynamic, elderly, Coronary Artery Bypass Grafting (CABG), surgery, Iran

INTRODUCTION

Due to the promotion of medical standards and better living conditions, control of diseases and reduce of infant and children mortality, life expectancy has been increased so that the elderly population in the world by the year 2050 will be reached to triple by 2000 and 2 billion people (Reed and Macfarlane, 2012). By increasing of age, probability of elderly suffering from chronic diseases is significantly increased. In most elderly cardiovascular disease has been reported as the most common and most important cause of hospitalization among the elderly (Kakhki *et al.*, 2013; Habibi *et al.*, 2012; Delpishe *et al.*, 2011). Among cardiovascular diseases, Coronary Artery Disease (CAD) is the most common, most serious and most dangerous cardiovascular disease that coronary artery disease in America is caused the deaths of half a million people per year and is responsible for 86 percent

of deaths of elderly people (Longo *et al.*, 2012; Lawrence, 2012). In Iran, cardiovascular diseases have been an increase of 20-40% and 35% of mortality in Iran is related to cardiovascular diseases (Gholipour and Tabrizi, 2012).

Coronary artery bypass surgery is an essential procedure in the treatment of coronary artery disease, especially in the elderly (Serruys *et al.*, 2010); Keenan *et al.*, 2005; Fulkner, 2001) which today is reached to 408 thousands operations per year in America (Tully and Baker, 2012). However, this surgery is considered a reliable method for improving of myocardial perfusion, but is associated complications such as cardiovascular complications such as bleeding, cardiac tamponade, myocardial infarction and heart failure, pulmonary complications such as gas exchange impairment, neurological complications such as cerebrovascular accident, renal complications, such as acute renal failure

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and electrolyte abnormalities, liver failure and infection. (Hinkle and Cheever, 2014; Lok *et al.*, 2014; Hosseininan *et al.*, 2014). Hemodynamic changes are one of the most important and the most common problems after bypass surgery of coronary artery. After these changes most patients are suffering Chronic and severe complications such as kidney dysfunction, neurological complications, respiratory disorders, intestinal and stomach problems and infection. As a result, the length of stay in intensive care units and readmission to the sector and ultimately will be increased the length of hospital stay (Goepfert *et al.*, 2013; Aronson and Varon, 2011) Keenan *et al.*, 2005). Especially if the patient is elderly, considering that can be more seen C0-morbidity for them, the morbidity and mortality after surgery are increased.

Monitoring of hemodynamic status and due to caused changes are the major tasks of nurses, for this reason, in order to prevent and control of arose complications after surgery, especially in the elderly are considered the most vulnerable groups. This study was performed to identify changes in hemodynamic parameters in elderly patients before and after coronary artery bypass graft surgery.

MATERIALS AND METHODS

This study is a descriptive-comparative study that has been performed to identify changes in hemodynamic parameters in elderly patients after coronary artery bypass graft surgery. 120 elderly people who were admitted in hospitals of Tehran were selected by convenience by sampling method. In this study, the elderly was participated who were 60 year or older have non-emergency surgery and had no previous history of coronary artery bypass graft. The data collection tool was characteristics questionnaire of demography, related factor, and the entry of hemodynamic parameters. To collect information about the SBP and DBP was used the needle and cuff sphygmomanometer and a stethoscope, and for number of HR was used of radial pulse count in one minute with a chronometer. To determine the validity, the questionnaire was given to ten members of the Faculty of Nursing and Midwifery of Shahid Beheshti, a specialist in heart surgery, cardiac anesthesiologists and three nurses working in heart ICU units. For reliability of the needle cuff manometers for all patients was used of one type of device with the same brands. Blood pressures was measured in 10 healthy volunteers two times with a distance of 3 min. By calculating the Pearson correlation coefficient (p= 0/943) was achieved if it is more than 0/8, the correlation coefficient is considered strong, and thus reliability of device was confirmed.

Sphygmomanometer at the start of sampling was calibrated with calibration device by the medical engineering company.

After obtaining consent from participants, the questionnaire was completed in terms of demographic characteristics. Hemodynamic parameters (SBP, DBP, MAP, PP, HR) were completed two days before the surgery in the morning and evening (at 10 am and 4 pm) in a special form. In the third and fourth days after surgery was required to continue to complete the form in terms of hemodynamic parameters after surgery.

Blood pressure of all the patients was measured by Non-invasive technique by using of needle cuff manometers with the same brand (ALPK2 V500). After 10 minutes of rest in a half-sitting position so that cuff was closed to the right hand of the patient so that is at the same surface of the heart.

Data analysis was performed by using SPSS 20 software. To investigate of data normalization was used of the Kolmogorov-Smirnov test. The results of this test showed that the data are normally distributed, that the data are normally distributed as a result was used of the paired t-test. To determine the hemodynamic changes descriptive statistics such as mean,%age and standard deviation were calculated. The significance level was considered 0/05.

RESULTS AND DISCUSSION

The average age of research participants was 66/50 ($\pm$ 5/79) years old, and the majority were male (78/3%), and had mean body mass index 25/39 ($\pm$ 5/ 79). Frequency distribution of other demographic variables and related factor in Table 1 and the variables during and after coronary artery bypass graft surgery have been shown in Table 2.

The results showed that before surgery, mean SBP is 123/91($\pm$ 16/52), mean DBP is equal to 76/38 ($\pm$ 10/69) before surgery, mean MAP is 92/23 ($\pm$ 12/15), and mean PP is 47/52 ($\pm$ 9/35) mm Hg and HR is 73/69 ($\pm$ 7/33) per minute. The average of these variables in the third and fourth days after surgery has been shown in Table 3. SBP

Table 1: Frequency distribution of demographic profile and related factor

The number (%)	Variable
42(35)	History of cigarette smoking
49(40/8)	Diabetes
89 (74/2)	High blood pressure
58 (48/3)	Hyperlipidemia
24(20)	kidney disease
31(25/8)	History of myocardial infarction
51(42/5)	Grade 3 New York Heart Association (NYHA)
100(83/3)	3 vessel disease
57(47/5)	3 graft

Table 2: The mean of variables during and after coronary artery bypass graft surgery

Average	Variable
65/57±(315/95)	Duration of surgery (min)
(43/27± 99/30)	The duration of use of heart and lungs pump (min)
(19/18±56/55)	The duration of aortic clamping (min)
(88/10±14/07)	Duration of intubation (h)

Table 3: Surgery Average hemodynamic parameters before and after coronary artery bypass graft surgery

Statistical data Hemodynamic Indicators	Average (SD) Four days later Surgery	Average (SD) third day After surgery	Average (SD) Before Surgery
SBP	(10/16±)28/119	(48/17±)27/119	(16/52±)123/91
DBP	(68/23±)73/45	(38/12±)82/69	(10/69±)76/38
MAP	(18/21±)88/73	(30/13±)30/86	(12/15±)92/23
PP	(24/04±)45/83	(11/05±)49/44	(35/9±)52/47
HR	(8/98±)86/21	(9/30±)86/57	(33/7±)69/73

had statistically significant reduction on the third day (p =0/024) and fourth (p = 0/013) after the surgery. As well as DBP had statistically significant reduction in the third and fourth days (p = 0/000) after the surgery. The MAP had statistically significant reduction in the third and fourth days (p = 0/000) after the surgery. The PP had significantly increase in the third day (p = 0/006), but in the fourth day did not have significant difference (p =0/502). The HR had statistically significant increase in the third and fourth days (p = 0/000) after the surgery.

Results of this study showed that the hemodynamic parameters (SBP, DBP, PP, MAP, HR) in elderly patients after of coronary artery surgery compared to before surgery have significant changes.

In comparison of the preoperative SBP with postoperative SBP, there was statistically a significant reduction in SBP mean in the third and fourth days, and most patients (48/3%) had SBP 100-120 mm Hg and 7.5% of patients had a SBP less than 100 mm Hg. In a study of Ahmadi that have been performed at the first 24 hoursCABG, Hypotension has been more prevalent in line with the present study (Masoule *et al.*, 2012). In Ebadi and et al study 86% of patients experienced hypotension in the first 24 h after CABG (Ebadi *et al.*, 2015). Among the causes of Hypotension in acute post-operative period can be pointed to causes of heart (myocardial compliance, heart attack), obstructive (tamponade, pulmonary embolism, tension pneumothorax), neurological (ischemic spinal cord as a result of ischemia or embolism events), Hypovolemia (bleeding, increased urine volume) and distribution (Anaphylaxis shock, Vasoplegia) (Andre and DelRossi, 2005). The present study shows that Hypotension still continues in the third and fourth day after surgery. In 8/3% of patients, SBP has been higher than 140 mm Hg. Hypertension in this population is a big problem because an increased risk of bleeding, especially

from aortic cannulation site, is caused the possibility of tearing the grafted artery, increase of cardiac afterload and increase of the workload of the left ventricle which can lead to an increased risk of ischemic heart and increase the risk of heart failure (Andre and DelRossi, 2005). Isolated Systolic Hypertension by itself can be account for 40% of adverse effects (left ventricular dysfunction, cerebrovascular disorders or cerebral vascular disease, kidney failure and death) after surgery (Aronson and Varon, 2011).

In comparison of the preoperative DBP with postoperative DBP, there was statistically a significant reduction in DBP mean in the third and fourth days, however, the majority had (82/5%) diastolic pressure in the normal range (90-60 mm Hg). In other studies, although DBP was measured in the first 24 h, most patients had DBP in the normal range (90-60 mm Hg), (Masoule *et al.*, 2012; Ebadi *et al.*, 2015) that are in line with this study, and patient on the third and fourth such period of acute postoperative had DBP in the normal range, however, this amount has been decreased compared to before surgery.

In comparison of the preoperative MAP with postoperative MAP was statistically significant decrease. More samples had (56/7%) MAP between 70 and 90 mmHg. In the study of Imanipour and Bassampour that has been measured hemodynamic parameters in the first 6 hours after surgery, 81/7% of MAP patients had between 70 and 95 mmHg, and this rate was 18.3% higher than 95 mm Hg (Imanipour and Bassampour, 2007). In Andre and Dalrousi study on the hemodynamic management in the first 24 h after coronary artery bypass graft surgery, reason of MAP reduction has been stated in myocardial compliance preload on the heart and vasodilation due to loss of vasomotor tone. Common cause of decrease in HR, lack of coordination atrium and ventricle and due to dysrhythmias or conduction defects have been referred, MAP goal has been pointed between 70-80 mm Hg (Andre and DelRossi, 2005). In this study has been shown that this reduction in MAP is always in the third and fourth days before surgery compared with before surgery. However, more patients of MAP (56/7%) were in the normal range. 8 patients (6/7%) of MAP had less than 70 days even in third and fourth respectively.

In comparison of the preoperative PP with postoperative PP, pulse pressure was statistically significant increase. The result of the study of Azizi *et al.* (2004) shows that PP in their early years with DBP and in middle age and old age with SBP are more correlated and because reduction in SBP was less than DBP reduction, resulting difference two variables have been further and PP has been increased. Nikolov and et al states that this

increase can be a long-term predictor of decreased survival (Nikolov *et al.*, (2010). Preoperative PP compared with the fourth day after surgery; statistically PP did not change significantly that is due to less changes in SBP on the fourth day compared to before surgery. Fontas and et al on the importance of the PP have been reported that an increase in PP is significantly associated with the increase in fatal and nonfatal stroke and cardiac complications after CABG (Fontes *et al.*, 2008). Especially in the elderly, the thickness of the walls of the arteries is mainly increased due to increase in collagen fibers and destruction of elastic fibers in the middle layer of the arteries and calcification. Vascular compliance is decreased, and PP is increased. The index is a stronger predictor of future cardiovascular events compared to SBP or DBP (Fakhrzadeh and Sharifi, 2012).

The average HR of elderly patients in the third and fourth day after CABG has been significant increase after coronary artery bypass graft compared to before surgery. In a study of Komatsu *et al.* (1997) HR of 10 patients has been recorded one day before surgery and then 1, 2, 3, 4, 5, 6, 7, 14, 21 and 28 days after CABG. The results showed a significant increase (p <0/05) in the number of HR up to 28 days after surgery and has been expressed that complete recovery has not been performed even up to 28 days after surgery compared before surgery that is in line with this study (Komatsu *et al.*, 1997). In a study of Hugo *et al.* (1994) that has been measured the number of HR one day before surgery, 1 and 5 days after CABG. The results showed a significant increase (p <0/05) in number of HR that is consistent with the present study.

HR are fluctuated under the influence of the sympathetic and parasympathetic nervous systems so that short-term and long-term changes in HR is a reflection of the autonomic nervous system function and Heart Rate Variability (HRV) analysis to is used as a monitoring tool to change function of the autonomic nervous system (Zali and Arefian, 2012). Many studies show that the autonomic nervous system function after CABG is disrupted. In a study of Birand and et al. has been measured HRV in 20 patients days before CABG, day 7, 30 and 3 months after surgery. The result of this study shows that all variables HRV is reduced after surgery and a gradual increase of is created up to 3 months before surgery (Birand *et al.*, 1999). In study of Latinov et al. that was recorded on 25 patients the HRV to 1 week before surgery, 6 weeks and 6 months later and showed that all indices of HRV are reduced, but the average HR from week 6 to 12 months after surgery compared to preoperative did not change (Laitio *et al.*, 2006). In studies which had longer follow-up period like

Demirel and et al. study the two days before CABG, 1 week, 3 month, 6 month, 1 year and 3 years later, 12 patients were followed for a complete recovery the result was that occurred within 3 years after surgery (Demirel *et al.*, 2002). In relation to the importance of this finding with other studies, show a strong correlation between the decrease in autonomic nervous system function and sudden death (Laitio *et al.*, 2007).

Before surgery, most patients had HR in the range of 60 to 80 beats per minute. But after studying, the majority had HR between 80-100 beats per minute. Andre and Delrosi say that the increase in HR in the first 24 h in response to the surgical procedure, chills and medication is occurred (Andre and DelRossi, 2005). The present study shows that the increase in HR in the third and fourth day is continued. The result of study Aboyans *et al.* (2008) show that the number of HR is connected complications (stroke, death) after surgery. With an increase of 20 beats per minute for 30-50% mortality rate is increased as a result, it can be predicted as an indicator to determine the amount of effects used.

Andre and DelRoosi (2005) are considered HR between 90-100 beats per minute for the first 24 h. And the relative bradycardia (70-80 beats per minute) and tachycardia (greater than 110 beats per minute) that has been known as abnormal patterns. In another study, Frank state that heartbeats are predicted both in the general population and in patients with coronary artery disease. In their follow-up period that was ($1/3 \pm$) $3/2$ years, they concluded that HR greater than 90 is correlated with complications such as death, acute coronary syndrome, fatal, transient ischemic attack, and reoperation, and they stated that HR greater than 90 is associated with poor prognosis in patients with coronary artery disease even after CABG.

CONCLUSION

Results of this study showed that the hemodynamic parameters (SBP, DBP, PP, MAP,HR) in elderly patients after of CABG compared to before surgery have significant changes. These changes are not only related to the acute period, and paying attention to these changes is very important even after the acute period of CABG as much as period of immediately after surgery, especially in older people who are more suffering underlying medical conditions. Therefore, necessity of monitoring of patients is essential such as acute period after surgery.

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