ANALYSIS

22(89), January - February, 2018

ISSN
2321–7359
EISSN
2321–7367

Medical Science

When to remove drains after coronary bypass surgery?

Ali Kemal Gür[1☼], Esra Eker[2], Arzu Esen Tekeli[3], Mehmet Coşkun Aykaç[4]

1.Yuzuncu Yil University, School of Medicine, Department of Cardiovascular Surgery, Van, Turkey. E-mail: dralikemal@gmail.com
2.Van State Training and Research Hospital, Clinic of Anesthesiology and Reanimation,Van, Turkey. E-mail: dresoseker@hotmail.com
3.Yuzuncu Yil University, School of Medicine, Department of Anesthesiology and Reanimation, Van, Turkey. E-mail: esentekeli190807@hotmail.com
4.Ercis State Hospital, Emergency Medicine Department, Van, Turkey. E-mail:mcoskun@gmail.com

☼**Corresponding Address:**
Assistant Prof.Dr.Ali Kemal GÜR
Yuzuncu Yil University, School of Medicine, Department of Cardiovascular Surgery
Campus Van, Turkey
Van, TURKEY
Mobile: +90536 563 26 71; Fax+90432 215 76 03
Word Count: 4609
E-mail: dralikemal@gmail.com

Author's contribution to the manuscript:

- Ali Kemal Gür: He made design of the study. He has made contribution acquisition of datas, analysis and drafting of the manuscript.
- Esra Eker: She has made contribution to acquisition of datas, analysis and drafting of the manuscript.
- Arzu Esen Tekeli: She has made contribution to acquisition of datas, analysis and drafting of the manuscript. She has made a substantial contribution to interpretation of datas and revising the manuscript for intellectual content. She prepared the manuscript.
- Mehmet Coşkun Aykaç: He has made contribution acquisition of datas, analysis and drafting of the manuscript.

Conflict of interest

All authors read and approved the final manuscript. Also, The authors declare that they have no conflicts of interest.

Article History
Received: 07 October 2017
Accepted: 14 November 2017
Published: January-February 2018

Citation
Ali Kemal Gür, Esra Eker, Arzu Esen Tekeli, Mehmet Coşkun Aykaç. When to remove drains after coronary bypass surgery?. *Medical Science*, 2018, 22(89), 38-44

ABSTRACT

Background: Mediastinal and thoracic drains after open heart surgery are a vital preventive measure against postoperative cardiac tamponade. In this study, we investigated when to remove mediastinal and thoracal drains in patients who underwent isolated coronary bypass surgery.

Material and Methods: A total of 446 patients who underwent elective isolated coronary artery bypass grafting (CABG) in our clinic between January 2015 and March 2017 were enrolled prospectively. Patients were divided into two groups: Group I (the last 24-hour drainage follow-up was under 150 ml) and Group II (last 24 hours drainage follow-up was under 50 ml). There were 210 patients (95 female, 115 male) in Group I and 236 patients (112 female, 124 male) in Group II. Postoperative Tamponade and pleural effusion rates, perioperative and postoperative blood usage rates, and preoperative demographic characteristics were recorded evaluated statistically.

Results: The average age of the patients included in the study was 59,5 ± 6,2, consisting of 239 male and 207 female patients. There were 210 patients (95 F, 115 M) in group I, 236 patients (112 F, 124 M) in group II. The mean amount of drainage; in Group I: 582 ± 123 ml, in Group II: 614 ± 205 ml. The average time of drain removal; Group I: 2.3 ± 0.5 days, Group II: 4.1 ± 0.3 days. Development rate of cardiac tamponade that required surgery on the first postoperative day; Group I: 5 (2.3%) and Group II: 3 (1.2%) respectively ($p<0.05$). Thoracentesis was required due to pleural effusion in 11 (5.2%) patients in group I and 6 (2.5%) patients in group II ($p<0.05$). The overall average age of the patients was 59.5 ± 6.2 and consisted of 239 male and 207 female patients.

Conclusion: It can be suggested that drains should not be removed until the drainage amount of the mediastinal and thoracal drains is reduced to 50 ml / day to further reduce the morbidity after isolated coronary bypass surgery.

Key Words: Cardiac surgery, drainage tubes, cardiac tamponade

1. INTRODUCTION

Every year in the world an average 1.25 millon people have heart operations. Coronary bypass operations are the most common among these operations.[1] Drain usage to avoid tamponade and pleural effusion due to postoperative bleeding is an indispensable application of cardiac surgeons. Post-operative pericardial fluid build-up can be caused by many factors such as female sex, preoperative anticoagulant and antiaggregant use, obesity, renal failure, emergency operations, low cardiac output, blood usage, long operation.[2] The rate of pleural effusion after cardiac surgery, though it tends to differ in different studies, is usually 1.5%.[3] After open heart surgery, drains are inserted both into the mediastinal region and the thoracic region. The mediastinal drains are placed in the subxiphoid region as a standard, but whether the thoracic drains are directed from the intercostal space or curved from the subxiphoid region to the thorax remain controversial.[4] The cause of this controversy is that the drains placed from the intercostal space tend to cause problems such as postoperative pain, atelectasis, low oxygenation and delayed wound healing.[5] Although there is no surgical discussion of drain usage in the thoracic spaces, there is no general consensus as to when drains should be removed either. Some surgical clinics have an idea of draining drains early, while some surgical clinics have an idea to withdrawlate. In some studies, chest X-Rays suggest that draining drains are beneficical.[6] It is crucial that only a single thoracic cavity should be opened in cardiac operations. Bilateral opening and bilateral drainage may lead to postoperative atelectasis due to postoperative respiratory distress.[4] Today, however, surgeons are implementing different procedures for operation technique and follow-up after operation. In cardiovascular surgery clinics, mediastinum drainage tubes and thoracic drainage tubes are usually taken on day 1st or 2nd day postoperatively.[7] The reason is that the drains are considered as foreign bodies in the mediastinum and this condition is likely to cause mediastinitis and deep sternal wound infections.[8] The main reason for the early removal of drains is the prevention of the risk

of infection. However, a second surgical procedure may be required to remove pericardial fluid accumulation, pericardial tamponade, haemodynamic deterioration and pericardial effusion due to collection of coagulum and fluid accumulation after the very early removal of mediastinum drainage tubes. Among these, postoperative acute pericardial tamponade, is a life-threatening condition requiring urgent surgical intervention.[9]

In this study, early and late removal of tube drains were investigated in terms of cardiac tamponade, pleural effusion, and mediastinitis / deep sternal wound infection development.

2. MATERIAL AND METHODS

A total of 446 patients who underwent elective isolated coronary artery bypass grafting (CABG) in our clinic between January 2015 and March 2017 were investigated retrospectively.

Mobility and mortality, especially cardiac tamponade, were investigated according to the removal time of the drains of the patients following the operations. Patients who underwent emergency surgery, patients with additional valve pathology, patients whom underwent additional surgery (ascending aorta replacement, congenital surgery), patients with preoperative acute myocardial infarction, patients with low ejection fraction after operation, patients with hemodialysis dependent renal failure with bleeding tendency were excluded from this study. Mortality and stroke occurring in Group 1 and Group 2 patients were excluded from our study. Patients taken into study were divided into two groups: Group I (the last 24-hour drainage follow-up was under 150 ml) and Group II (last 24 hours drainage follow-up was under 50 ml). EuroSCORE was used for pre-operative risk scoring for all patients. All patients underwent surgery with median sternotomy under general anesthesia. Premedication with 3 mg Dormicum and ½ Atropine was taken to the operating room before the operation. General anesthesia was administrated to the patient with 1 mg/kg Propofol, 7 mg/kg Fentanyl, 0.7 mg/kg Rocuronium and 2 mg Dormicum. Intravenous 2 mg/kg/h Proferol and 8 mcg/kg/h Fentanyl infusion were initiated. The esophageal temperature probe was placed before heparinization to control the temperature of the patients. The demographic data's of the patients in terms of hypertension (HT), diabetes mellitus (DM), chronic obstructive pulmonary disease (COPD), smoking habits, hypercholesterolemia, aortic cross clamping time and postoperative electrolyte imbalances before and after the operation were recorded in detail. Patients were operated under general anesthesia, under cardiopulmonary bypass with median sternotomy, and by beating heart cardiovasculary bypass technique. The right jugular vein was usually used for the central catheter. Catheterization was performed via the left juguler vein or right subclavian vein for patients who could not implented. The esophageal temperature probe, for temperature control, was placed before heparinization. Left internal mammarian artery (LMA) was used for left anterior descending artery (LAD) in all patients in both groups. After heparinization, medication was administered such that the activated clotting time (ACT) was set over 200 for the beating heart technique and 460 for the cardiopulmonary bypass. For coronary bypass surgery using CPB, first aortic cannula, then two-stage venous cannula and aortic root needle for antegrade cardioplegia were used. Blood cardioplegia was used every 20 minutes for cardioplegia. Octopus and Starfish (Medtronic, Inc., Minneapolis, Minn., USA) coronary stabilizers were used for coronary stabilization for the bypassed heart bypass. None of the patients in our study had a right thorax drain. During the operation, variables such as total number of grafts, inotropic agent usage, CPB time (minutes), cross clamp time (minutes) were recorded and evaluated.

3. RESULTS

The average age of the patients in the study was 59.5 ± 6.2. The study consisted of 239 male and 207 female patients. The mean age at men was 59.4 years, the range was 42-78 years, the mean age at women was 63.2 years and the range was 52-71 years. Preoperative demographic data were given in Table 1. Patients were divided into two groups: Group I (n=210, the last 24-hour drainage follow-up was under 150 ml) and Group II (n=236, last 24 hours drainage follow-up was under 50 ml). Acetylsalicylic acid was present in 122 patients of Group I (58%) and in 143 patients of Group II (61%) (p = 0.009). The use of acetylsalicylic acid in any of the patients was not stopped during the preoperative period. In 128 patients of group I (61%), in 134 patients of group II (57%) had hypertension (p ≤0.001). 94 (45%) patients in group I and 125 (53%) patients in group II had diabetes mellitus (p = 0.002). The average number of grafts used and side clamp usage were close to each other and there was no statistical difference (p = 0.002). LIMA graft for LAD was used in all patients. During the operation, the difference in the amount of aspirated blood from the surgical zone was not remarkably different between patients. From group I, 78 patients (37.1%) 1 unit, 36 patients (17.1%) 2 units, 25 patients (11.9%) were given 3 or more units of blood or blood products (p = 0.001). From group II, 94 patients (39.8%) 1 unit, 42 patients (17.7%) 2 units, 17 patients (7.2%) were given 3 or more blood or blood products (p = 0.001). The mean hemoglobin level during operation was 11,38 ± 1,65 (p = 0.001) in Group I off-pump, on-pump 8,42 ± 1,43 (p = 0.001), Group II off-pump 11,18 ± 1, 38 (p = 0.001), on-pump 8,32 ± 1.28 respectively (p = 0.001). The perioperative respective data of the patients were given in Table 2.

In group I, total drainage was 582 ± 123 ml and in group II, it was 614 ± 205 ml (p = 0.002). Development rate of cardiac tamponade that required surgery on the first postoperative day; Group I: 5 (2.3%) and Group II: 3 (1.2%) were statistically significant (p <0.05). Thoracentesis was required due to pleural effusion in 11 (5.2%) patients in group I and 6 (2.5%) patients in group II. This was statistically significant (p <0.05). Pleural effusions were confirmed and followed with chest X-Rays and thoracentesis was made through the 5th intercostal space in each patient. Surgical intervention was not applied to pleural effusion in any patient. Then, diuretics and anti-edema medications were given as medical treatment. None of the patients had mediastinitis. While AF developed in 43 (20.1%) patients in Group I, AF developed in 52 (22%) patients in Group II (p = 0.044). There was no statistically significant difference in anastomic numbers between the two groups (p = 0.002). Drains were removed in 2.3 ± 0.5 days in Group I and 4.1 ± 0.3 days in Group II. The mean hospital stay in the hospital was 9.4 ± 1.3 days in Group I and 8.7 ± 1.1 days in Group 2 (p = 0.44). Patients did not have mediastinal widening or pleural fluid images at the second month of follow-up. The postoperative data of the patients was given in Table 3.

Table 1 Preoperative Patient Data

Variable	Group I (n=210)	Group II (n=236)	p value
Mean Age (years)	59.2 ± 9.2	60.5 ± 8.3	<0.001
Sex (Male/Female)	115M/95F	124M/112F	0.003
Mean BMI(kg/m^2)	25.4 ± 3.8	27.2 ± 4.1	0.009
Past MI history n (%)	29 (% 47)	43 (% 54)	<0.001
Mean EF (%)	42 ± 4.8	45 ± 2.1	0.005
ASA usage n (%)	122 (% 58)	143 (% 61)	0.009
Hipertension n (%)	128 (% 61)	134(% 57)	<0.001
Diabetes Mellitus n (%)	94 (% 45)	125 (% 53)	0.002
Chronic Obstructive Pulmonary Disease n (%)	40(%19)	51 (%21.1)	0.003
Smoking History n (%)	107 (%50.9)	115 (%48.7)	0.003
Preop Hg Levels (Dr/dl)	13 ± 1.4	12± 1.3	0.002
Preop INR	1.3 ± 0.12	1.2 ± 0.32	0.001
Preop Platelet Count	245.000 ± 15.000	305.000 ± 16.000	0.001
NYHA Functional Class (1-5)	2.89±0.88	2.88±0.78	0.001
EUROSCORE	3.27±2.48	2.86±2.52	0.003

Values are n (%) for categorical variables and mean ± SD for continuous variables
MI: Myocard Infarction
INR: International Normalized Ratio,
NYHA: New York Heart Association
BMI: Body Mass Index

Table 2 Operation Data

Variable	Group I (n=210)	Group II (n=236)	p value
Number of Anastomoses	2.41±0.58	2.18±0.91	0.002
Total Bypass Duration (minutes)	88±37	84±29	0.001
Aortic Cross Clamp Duration (minutes)	62±35	58±21	0.003
Aspirated Blood Amount During Operation (cc)	286 ± 123	343 ± 191	0.002
Amount of Blood Product Used During Operation (units)	1.2 ± 0.5	1.1 ± 0.8	0.001

Values are n (%) for categorical variables and mean ± SD for continuous variables

Table 3 Postoperative Patient Data

Variable	Group I (n=210)	Group II (n=236)	p value
Total Drainage	582 ± 123	614 ± 205	0.002
Total Blood Transfusion	1.4 ± 0.3	1.6± 0.3	0.001
Hg	9.4 ± 2.1	9.1 ± 2.0	0.002
Revision surgery rate in the first 48 Hours Due to Bleeding	5 (% 2.3)	3 (% 1.2)	<0.05
Pleural effusion	11 (% 5.2)	6 (% 2.5)	<0.05
Postoperative AF	43 (% 20.4)	52 (% 22)	0.044
Platelet Count	215.000 ± 23.000	292.000 ± 19.000	0.001
Intubation Duration (hours)	8.3±1.5	9.1±1.3	0.002
Duration in Intensive Care (days)	2.3 ± 0.5	2.4 ± 0.03	0.065
Total Hospital Stay (days)	9.4 ± 1.3	8.7 ± 1.1	0.440
Mean Removal of the drains (days)	2.3 ± 0.5	4.1 ± 0.3	<0.05
Mediastinitis / Deep Sternal Infection	-	-	

Values are n (%) for categorical variables and mean ± SD for continuous variables
AF: Atrial Fibrillation

3.1. Statistics

Descriptive statistics, mean ± standard deviation (mean ± SD), percentage values were used for both groups of data. In comparison of both groups, t test and Wilcoxon test were used. The obtained data were analyzed using Statistical Package for the Social Sciences 17.0 (SPSS 17.0, SPSS Inc, Chicago, IL) software. In the comparison, p <0.05 was considered statistically significant.

4. DISCUSSION

In this study, we describe a procedure performed entirely in the direction of clinical routines in the practice of cardiovascular surgery. Tube thoracostomy drains are used for drainage of the fluid that accumulates in the mediastinum after open heart surgery. Generally, 36 Fr tube for mediastinum is placed in the subxiphoid region, 32 Fr tube for thoracic space is inserted from the intercostal space at the 5th or 6th below the left breast areola alignment.[10] Because we used LIMA in all of our cases and we opened the left pleura during the removal of the LIMA, we put one drain to the left thorax. We did not put a drain to the right thorax unless the right pleura was opened. No right thoracic drain was applied to any patient in our study. In the literature there are many different opinions about the timing of removal of drains. It is generally argued that drains should be removed early. Gerçekoğlu et al.[11] pointed out that the drains should be removed when the active bleeding stops and serosanguineous drainage begins. Sadeghi et al.[12] emphasized that the early withdrawal of drains resulted in early surgical recovery with reduced postoperative pain. Smulders et al.[13] emphasized that drains should be taken in the first 24 hours after operation and removal of drains is not a risk factor for tamponade development during this period, and even that early removal of drains reduces the risk of infection. In the same way, Abramov et al.[14] emphasized that drains must be removed in the first 24 hours. Viquerat et al.[15] reported that pericardial fluid accumulation was the most important factor in the development of postpericardiotomy syndrome with scintigraphic analysis and emphasized that drains should not be removed without serous structure.

In a general the results are in the opposite direction of our findings. There is a consensus on the early removal of drains. This consensus is mainly aimed at preventing the development of infection, in which no supporting article has been found in the literature. And secondly, the idea that the early removal of drains contributes positively to surgical recovery in general term is strong in our practice. But in our study, we have come to the conclusion that we should not remove drains until daily drainage becomes lower than a certain level to avoid the need of a second operation. The two most important issues affecting general morbidity and mortality after surgery are postoperative myocardial infarction[16] and post-operative cardiac tamponade.[17]

The cardiac tamponade, which developed mostly during intensive care period, manifested itself with typical Beck triad (increase in systemic venous pressure, decrease in systemic arterial pressure, silent heart). However, in cases of hypotension, oliguria, tachycardia (Chest X-Ray, echocardiography) after a diagnosis of tamponade made via further analysis, a revision procedure was applied.[18] Tamponade within the first day and the next ten days after the operation; Group I: 5 (2.3%), Group II: 3 (1.2%) and these

results were statistically significant. Pleural effusion, on the other hand, in Group I: 11 (5.2%) and in Group II: 6 (2.5%) this also was statistically significant.

The urine output, which is the one of the most important indicators of postoperative cardiac adequacy, is a parameter that is very useful in diagnosing and monitoring the cardiac tamponade. It is also useful in follow up of revision surgeries. Because of the poor echogenicity of the echocardiography performed in the postoperative period, cardiologists often have difficulties in diagnosing cardiac tamponade. In this case, it seems more reasonable to evaluate the patient clinically for revision surgery. X-Rays taken on the first postoperative day provide important information. Despite the mediastinal widening, most of the patients' drains are removed if there is no drainage in the last few hours. The strategy here is to drain the stuffy drain. If it cannot be opened, the drains must be aspirated and opened in a sterile manner.

The cardiac tamponade, developed within the first 48 hours, is intertwined with the two conditions requiring mediastinal revision surgery; bleeding and tamponade.[19] Clearly, in our study, the bleeding-related revision surgery rate in the first 48 hours was 5% in Group I and 3% in Group II, whereas pleural effusion was 5.2% in Group I and 2.5% in Group II and statistically significant. We think that this difference is related to the timing of the removal of the drains. Of course, when the number of the sample group is inadequate and the complexity of the bleeding-clotting system is taken into consideration, new studies are needed in this regard.

As is known, cardiac tamponade development after cardiac surgery increases mortality and morbidity and is an important issue that needs to be diagnosed and treated quickly. The tamponade seen after cardiac surgery can be caused by various bleeding focus. In a study performed by Ates et al.[20], 3622 patients that underwent open heart operations were investigated. 123 of these patients were taken revision surgery. Surgeons couldn't find the bleeding focus in 25% of the patients, and 13% of the patients had bleeding in the internal mammary artery or its branches. This situation may also depend on the receiving anticoagulant and antiaggregant therapy of patient in the preoperative period. In the literature, It is reported that acetylsalicylic acid (ASA) should be stopped at least 5 days prior to surgery to avoid bleeding in the postoperative period.[21] In a study conducted by Goldhammer et al.[22], 1571 patients were studied and it was stated that ASA usage in the preoperative period caused bleeding and blood transfusion requirements in the postoperative period.

In a study conducted by Xiao et al.[23], 1418 off-pump coronary bypass patients were examined and it was stated that preoperative ASA usage did not increase blood loss, blood transfusion requirements or postoperative mortality rates. However, many studies have suggested that the use of clopidogrel and warfarin in the preoperative period causes bleeding perioperatively and postoperatively.[24] It was emphasized that clopidogrel should be stopped 5 days prior to surgery and for warfarin users, operation has to be postponed until INR levels are normalized.[25]

The reason for the early removal of the drains after cardiac surgery is to prevent the development of mediastinitis. In this study, none of the patients developed any infection. This was confirmed by CBC, CRP and sedimentation.

The respiratory mechanics and general healing process of patients who have undergone open heart surgery are very much related to each other. Especially pleural effusion, which causes respiratory distress and requires intervention, is very important in terms of postoperative patient comfort and healing process due to its invasive nature. Furthermore, if a complication develops then it can have catastrophic consequences. In our study, pleural effusion was observed in 5.2% in Group I and 2.5% in Group II and there was a statistically significant difference ($p \leq 0.05$). In general, no secondary surgical intervention (such as tube thoracostomy) was applied to any patient and the thoracic fluid was evacuated by thoracentesis. After discharge, the patients with pleural effusion were treated with diuretic agents and anti-edema medication. Chest X-Rays taken at 2 month follow-up of the patients did not indicate any evidence of mediastinal widening or pleural effusion.

5. CONCLUSION

We think that early removal of the drains after cardiac surgery leads to the development of cardiac tamponade and pleural effusion, which have adverse effects on the clinical and hemodynamic parameters of the patient. To further reduce morbidity after isolated coronary bypass surgery, we think that the mediastinal and thoracal drains should not be removed before daily drainage volume becomes less than 50 ml. With this study, we believe that late removal of drains does not have a link to complications, such as mediastinitis and deep sternal infections, which are complications that pose a serious problem for cardiac surgeons.

REFERENCE

1. Dıxon B, Reid D, Collins M, Newcomb A, Rosalion A, Yap C-H et al. The operating surgeon is an independent predictor of chest tube drainage following cardiac surgery. J Cardiothorac Vasc Anesth. 2014; 28(2):242-246.
2. Pompilio G, Filippini S, Agrifoglio M, Merati E, Lauri G, Salis S et al. Determinants of pericardial drainage for cardiac tamponade following cardiac surgery. Eur J Cardiothorac Surg. 2011; 39:e107-113.

3. Ashikhmina EA, Schaff HV, Sinak LJ, Li Z, Dearani JA, Suri RM et al. Pericardial effusion after cardiac surgery: risk factors, patient profiles, and contemporary management. Ann Thorac Surg. 2010; 89:112-118.
4. Elnasr MA, Arafat AA, Wahab AA, Taha AH. Intercostal versus subxiphoid approach for pleural drainage post coronary artery bypass grafting. J Egypt Soc Cardio-Thorac Surg. 2017; 25(1):8-13.
5. Ritchie M, Brown C, Bowling M. Chest tubes: indications, sizing, placement, and management. Clin Pulm Med. 2017;24(1):37-53.
6. McCormick JT, O'mara MS, Paspasavas PK,Caushaj PF. The use of routine chest x-ray films after chest tube removal in postoperative cardiac patients. Ann Thorac Surg. 2002; 74(2):2161-2164.
7. Pepi M, Muratori M, Barbier P, Doria E, Arena V, Berti M et al. Pericardial effusion after cardiac surgery: incidence, site, size, and haemodynamic consequences. Br Heart J. 1994;72(4):327-331.
8. Cotogni P, Barbero C, Rinaldi M. Deep sternal wound infection after cardiac surgery: evidences and controversies. World J Crit Care Med. 2015; 4(4):265-273.
9. Christensen MC, Dzievoir F, Kempel A, Von Heyman C. Increased chest tube drainage is independently associated with adverse outcome after cardiac surgery. J Cardiothorac Vasc Anesth. 2012; 26(1):46-51.
10. Le J, Buth KJ, Hirsch GM, Legare JF. Does more than a single chest tube for mediastinal drainage affect outcomes after cardiac surgery? Can J Surg. 2015; 58(2):100-106.
11. Gercekoglu H, Aydin NB, Dagdeviren B, Ozkul V, Sener T, Demirtas M et al. Effect of timing of chest tube removal on development of pericardial effusion following cardiac surgery. J Card Surg. 2003; 18(3):217–224.
12. Mirmohammad M, Etesampour A, Gharipour AM, Shariat Z, Nilforoush P,Saedi M et al. Early chest tube removals after coronary artery bypass graft surgery. N Am J Med Sci. 2009; 1(7): 333–337.
13. Smulders YM, Wiepking ME, Moulijn AC, Koolen JJ, van Wezel HB, Visser CA. How soon should drainage tubes be removed after cardiac operations? Ann Thorac Surg. 1989; 48(4):540-543.
14. Abramov D, Yeshayahu M, Tsodikov V, Gatot I, Orman S, Gavriel A et al. Timing of chest tube removal after coronary artery bypass surgery. J Card Surg. 2005; 20(2):142-146.
15. Viquerat CE, Hansen RM, Botvinick EH, Dae MW, Wiener-Kronish JP, Matthay MA. Undrained bloody pericardial effusion in the early postoperative period after coronary bypass surgery: a prospective blood pool study. Am Heart J. 1985; 110(2):335-341.
16. Yu PJ, Cassiere HA, Kohn N, Dellis SL, Manetta F, Hartman AR. Myocardial Infarction Classification on Outcomes in Nonemergent Coronary Artery Bypass Grafting. Ann Thorac Surg. 2015; 100(5):1588-1593.
17. Borkon AM, Schaff HV, Gardner TJ, Merrill WH, Brawley RK, Donahoo JS et al. Diagnosis and management of postoperative pericardial effusions and late cardiac tamponade following open-heart surgery. Ann Thorac Surg. 1981; 31(6):512-519.
18. Doğan R. Cardiovasculary Surgery. Editors; Paç M, Akçevin A, Aka SA, Büket S, Sarıoğlu T. A principle book of Turkısh Cardiovasculary Surgery Soceity. 2. Edition. Nobel Publishing, Istanbul. 2013; 337-367
19. Encalada JF, Campelos P, Delgado C, Ventosa G, Quintana E, Sandoval E et al. Surgery in the cardiovascular surgical intensive care unit. Cir Esp. 2015; 94(4):227-231.
20. Ateş M, Kayacıoğlu I, Şaşkın H, Şensöz Y, Yangel M, Ekinci A et al. Açık Kalp Cerrahisi sonrası kanama nedeniyle yapılan revizyon ameliyatları (2 yıllık izlem) Türk Göğüs Kalp Damar Cerrahi Derg. 2003; 11:207-210.
21. Veen JJ. And Makris M. Management of peri-operative anti-thrombotic therapy. Anaesth. 2015; 70(l): 58–67.
22. Goldhammer JE, Marhefka GD, Daskalakis C, Berguson MW, Bowen JE, Diehl JT et al. The effect of aspirin on bleeding and transfusion in contemporary cardiac surgery. PLoS One. 2015; 10(7): 1-10.
23. Xiao F, Wu H, Sun H, Pan S, Xu J, Song Y. Effect of preoperatively continued aspirin use on early and mid-term outcomes in off-pump coronary bypass surgery: A propensity score-matched study of 1418 patients. PLoS One. 2015;23: 1-13.
24. Bedeir K, Bliden K, Tantry U, Gurbel PA, Mahla E. Timing of coronary bypass surgery in patients receiving clopidogrel: The role of verify now. Can J Cardiol. 2016; 32(6): 724–725.
25. Welsh KJ, Nedelcu E, Bai Y, Wahed A, Klein K, Tint H et all. How do we manage cardiopulmonary bypass coagulopathy? Transfusion. 2014; 54(9):2158-2166.