Outcomes of Preoperative Antiplatelet Therapy in Patients with Acute Type A Aortic Dissection

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August 1, 2021

Abstract

Background: Acute type A aortic dissection(ATAAD) is life-threatening and requires immediate surgery. Sudden chest pain may lead to a risk of misdiagnosis as acute coronary syndrome and may lead to subsequent antiplatelet therapy. We used the Chinese Acute Aortic Syndrome Collaboration Database (AAS) to study the effects of antiplatelet therapy (APT) on clinical outcomes. Methods: The AAS database is a retrospective multicentre database where 31 of 3092 had APT with aspirin or clopidogrel or both before surgery. Before and after propensity score matching, the incidence of complications and mortality was compared between APT and non-APT patients by using a logistic regression model. The sample remaining after PSM was 30 in the APT group and 80 in the non-APT group. Results: The sample remaining after matching was 30 in the APT group and 80 in the non-APT group. We found 10 cases with percutaneous coronary intervention in the APT group(33.3%). The APT group received more volume of packed red blood cell (RBC), 8.4±6.05 units; plasma, 401.67±727 ml, and platelet transfusion(14.07±8.92 units). The drainage volume was much more in the APT group(5009.37±2131.44ml, P=0.004). Mortality was higher in APT group(26% vs 10%, P=0.027). The preoperative APT was independent predictor of mortality(OR 6.808, 95% CI1.554-29.828, P = 0.011). Conclusion: APT prior to ATAAD repair was associated with more transfusions and higher early mortality. The timing of surgery should be carefully considered based on the patient's status and the surgeon's experience.

Introduction

Acute type A aortic dissection(ATAAD) is a life-threatening disease. It has been reported that ATAAD patients die at a rate of 1% to 2% per hour on the first day of onset if they do not undergo surgery immediately[1]. Operation should be performed once the AD is confirmed[2]. However, when patients suffer from some special conditions, such as branch vessel malperfusion, cerebral hemorrhage, etc., the timing of surgery remains controversial[3,4]. Antiplatelet therapy (APT) is sometimes used in patients with ATAAD who are misdiagnosed as acute coronary syndrome(ACS) in the emergency department, both of which represent typical clinical manifestations of sudden chest pain. Dual antiplatelet therapy is the first line of treatment in CAD patients, especially for those received percutaneous stent implantation(PCI) , and it consists of acetylsalicylic acid (ASA) and a P2Y12 antagonist, e.g. clopidogrel, prasugrel or ticagrelor. Aspirin and clopidogrel are commonly used in emergency departments in China. Oral antiplatelet therapy before cardiac surgery might increase the risk of postoperative bleeding, transfusion and re-exploration for bleeding[5]. It is commended that patients should stop APT for 3-7 days before non-emergent cardiac surgery in order to reduce blood loss. When discussing prognosis of patients with AD who mistaken of APT, the timing of operation and clinical outcomes still remain controversial. Some studies have found that preoperative use of APT increases perioperative mortality [6,7], while other studies have different results [8,9]. A recent study found that APT before repair of acute aortic dissection is associated with increased bleeding and transfusion, but not mortality[10]. However, different types and doses of APT may lead to different clinical outcomes. Asians have different platelet antigens than Europeans and Americans[11]. There is surprisingly little information that can be used to predict these clinical outcomes from Asia.

In order to study the impact of preoperative APT on the clinical outcome of Chinese ATAAD patients, we conducted this study by extracting data from the Chinese Acute Aortic Syndrome Collaborative (AAS).

Methods:

The Chinese Acute Aortic Syndrome Collaborative(AAS,*http://139.129.128.68:8080/AASCN/index.shtml*), a network of aortic surgeons across China, complied a comprehensive database of consecutive aortic surgery cases. There are 10 cardiovascular centers with a total of 3931 cases in the database, including 3,092 cases (78.6 %) Stanford A aortic dissection and 839 cases (21.4%) of Stanford B aortic dissection. Each cardiovascular center obtained local ethics approval from their respective institutional review boards. After giving their written informed consent, patients underwent aortic surgery urgently or emergently depending on different centers' protocol. The detailed information of patients diagnosed with type A acute aortic dissection was extracted from our database, including preoperative status, surgical treatment, postoperative course and survival.

We found 31 patients who received APT before aortic operation in Stanford A group. All patients discontinued less than 12 hours before receiving surgery and deep hypothermic circulatory arrest(DHCA). Other patients(3061 cases) with Stanford A aortic dissection were not treated with any platelet inhibitor before surgery. We excluded 693 cases with missing information(baseline characteristics) in the non-APT group, 1020 patients without DHCA. Remaining patients (1379 cases) with Stanford A aortic dissection were enrolled in the non-APT group.

Clinical management

The definition of acute aortic dissection was surgery within 14 days of presentation of symptoms. Penn class [12] was defined as A: no ischaemia; B: localized ischaemia; C: generalized ischaemia; and B and C: both localized and generalized ischaemia. All complications were recorded during the time between surgery and discharge from the hospital.

Patients were routinely operated on at the involved centers. In general, median sternotomy was performed, cardiopulmonary bypass and hypothermic cardiac arrest with or without cerebral perfusion were used(see Video 1). Axillary cannulation and femoral cannulation was preferred in our department. Retrograde perfusion cannula was inserted through the coronary sinus. The total arch replacement was performed if the arch was involved. DHCA is established when the nasopharyngeal temperature is below 20-24 ° C. Unilateral selective cerebral perfusion was performed through the right axillary artery at a flow rate of 5-10 mL / kg per minute. Standard frozen elephant truck operation was performed using a stent graft(Microport, Shanghai,China) and a four-branch graft vessel(Maquet. Inc., Germany). Blood transfusion protocols were implemented in all centers, but the final decision on whether to perform blood transfusion, including plasma, platelet and cryoprecipitate, was always the clinical decision made by the responsible physician. The practice of routine administration of prohaemostatic drugs (such as anti-fibrinolytic agents, fibrinogen concentrates and activated factor VII concentrates) varied with center and time.

Statistical analysis

Summary statistics are presented as frequencies and percents for categorical values and as mean values with standard deviation(SD) for continuous values.

A propensity score (PS) matching was performed using 15 variables including medical history and the status at presentation(preoperative variables such as age, gender, hypertension, renal dysfunction, preoperative cerebral complications, history of smoking, , preoperative platelet count, LVEF, aortic diameter, BSA; surgical variables, such as Cardiopulmonary bypass time, Cross-Clamp time, DHCA time, nadir temperature during DHCA, and operating time). Matching was performed one-to-three with a caliper width of 0.03 of logit of the propensity score[13]. The sample remaining after PSM was 30 in APT group and 80 in non-APT group. A logistic regression model with APT as the outcome variable was carried out. The standardized mean difference(SMD) was provided before and after matching. Further details on the PSM are presented in the Supplementary Material. Distribution of PSM is shown in figure 2. The matched groups were analyzed by

means of logistic regression, and the results were presented as odds ratio (OR) with 95% confidence interval (CI). To compare patients with and without APT, chi-square and Student t tests were used. Wilcoxon rank-sum test was used for continuous non-parametric variables and presented as mean values with the median. All tests were conducted at a 0.05 significance level. All statistical analyses were performed by a professional statistician using the STATA Software version 14.0(StataCorp LP, College Station, Tex) and SPSS 23.0 software(SPSS, Chicago, IL).

Results:

The parameters of APT group and non-ATP group before and after matching were shown in Table 1. Only about 1% of patients undergoing ATAAD surgery received APT before surgery. The mean age of the APT group was similar to that of the non-APT group(53.87 vs 53.54). In the APT group, renal dysfunction, smoking, and chronic obstructive pulmonary disease (COPD) were similar with non-APT group. The incidences of cardiac malperfusion and cerebral malperfusion were similar in both groups. We found more cases with percutaneous coronary intervention(PCI) in the APT group(33.3% vs 0%). The other preoperative parameters are similar between both groups.

Among patients receiving APT preoperatively, 5 patients were prescribed with aspirin for 10 to 30 months, 2 with clopidogrel for 10 and 20 months, 5 with aspirin and Plavix between 10 and 53 months, and 19 with aspirin and clopidogrel less than 12 hours in the emergency department before surgery. One patient with both aspirin and Plavix was excluded after matching. Surprisingly, Ticagrelor was not used for patients in our database. Due to data limitation of APT group, we did not perform subgroup analysis.

The operation time, cardiopulmonary bypass(CPB) time, cross-clamp time and DHCA time were 213.07±71.61 minutes, 120.90±50.50 minutes, and 21.50±12.65 minutes, respectively. There was no difference in surgical characteristics between the two groups.

Perioperative blood transfusion and postoperative drainage volume were crucial in this study. The blood transfusion measures in APT group were as follows: packed red blood cell(RBC), 8.40±6.05 units; plasma, 401.67±727.0 ml; cryoprecipitate, 5.77±9.17 units, and platelet transfusion, 14.07±8.92 units(see Figure 1B). The APT group received more volume of RBC , plasma, and platelet transfusion. We also measured the total drainage(including thoracic drainage) volume. The drainage volume was much more in the APT group(5009.37±2131.44ml,P =0.004).

The re-operation rate was similar in both groups(due to bleeding and left ventricular dysfunction). There was no difference in postoperative renal failure, cerebral accident, post-operative myocardial infarction, ventilation time. We found the mortality was higher in APT group(26.7% vs 10%, P =0.027,see Figure 1A).

The preoperative antiplatelet therapy was independent predictor of mortality(OR 6.808, 95% CI1.554-29.828, P = 0.011, see table 2).

Comment:

The main finding of this retrospective study was that mistaken of APT in AD patients could lead to more postoperative drainage, more transfusion and higher mortality.

Acute chest pain was sometimes diagnosed with acute coronary syndrome(ACS)[14]. The diagnosis of ACS requires electrocardiogram and cardiac markers. Electrocardiogram showed myocardial ischemia sometimes, especially in these patients received PCI, but cardiac markers did not increase dynamically. In our study, 33% of patients in APT group received PCI. When symptoms appear, they tend to take antiplatelet drugs at home or in the emergency department. Therefore, echocardiography and computer tomography are the keys to the accurate diagnosis and mistaking of antiplatelet therapy. However, in some cases, aortic dissection progresses to involve the coronary ostia. This belongs to Penn classification c or bc[12]. Myocardial ischemia on presentation (Penn class c or class bc) was an independent predictor of mortality[23]. Whether these patients are suitable for APT remains controversial. We did not find higher incidence of postoperative MI in APT group.

Bleeding complications and transfusion are harmful. We measure the thoracic and pericardial drainage totally until the volume was less than 100ml per day, and then pulled out the tube. We found that even if the reoperation rate is similar, APT may still cause more bleeding. To improve coagulation and stop bleeding during and after the operation, more plasma and platelet were transfused. Perioperative bleeding and blood transfusion are well-known risk factors leading to serious consequences for different cardiac and non-cardiac surgical procedures[15,16]. Hansson [7] found that patients receiving APT had increased bleeding and increased blood transfusions, which was associated with higher mortality. Our study confirm this correlation between APT and mortality. However, only 1percent of AD patients received APT was detected in our database. We speculate that with the improvement of the diagnosis and treatment ability of primary hospitals, the enhanced CT examination of patients with acute chest pain has improved the diagnosis of AD in China.

Platelet transfusion can be effective in counteracting APT, albeit with a lesser effect on ticagrelor compared to clopidogrel-treated patients[17]. In our study, 5 patients were prescribed with aspirin, 2 with clopidogrel, 23 with aspirin and clopidogrel less than 12 hours in the emergency department before surgery. Surprisingly, ticagrelor, the stronger antiplatelet medicine, was not used. It was impossible to conduct separate analyses comparing the different antiplatelet medicines. There is a tendency to increase the use of activated factor VII in APT patients during surgery. The safety of activated factor VII in patients with AD has been previously reported[18]. Aprotinin is a non-specific serine protease inhibitor with anti-fibrinolytic properties[19], which is also used by some research centers. The use of aprotinin has been associated with reduced bleeding and transfusions, but there have also been reports showing an increased risk of myocardial infarction, renal failure, and death[20]. We did not use aportinin in cardiac surgery. We believe that the surgical control of bleeding is the most important point, especially in patients received DHCA and longer CPB time. DHCA may cause severe disorders of the coagulation system, platelet dysfunction, and a high incidence of postoperative bleeding[21]. We try our best to shorten the DHCA time(20 minutes) to preserve platelet function and reduce organ ischemia time. Platelet-pheresis is also recommended before DHCA for platelet protection[22]. For each AD patient, we removed platelets from the blood before CPB and retransfused after separation from CPB. However, AD patients received APT can only benefit little from this technique.

Some authors recommend that all operable AD patients undergo immediate surgery because their mortality increases over time[24]. Some surgeons may think that delayed surgery should be considered to avoid of bleeding and transfusions, especially in patients with stable hemodynamics and no malperfusion or tamponade. In our center, unless there is a coma, we will never delay the surgery of AD patients with APT. Platelet function is measured before surgery in our department nowadays, including ADP-induced platelet aggregation and arachidonic acid-induced platelet aggregation. We can better understand the coagulation function of these patients. We make a more careful anastomosis and surgical control of bleeding in these patients, and prepare more coagulation drugs, just in case. The surgeon understands the challenges facing this patient cohort and should strike a balance between surgical risks and benefits. Also, a hemiarch may favor over total arch if the patient had received antiplatelet drugs. When we talk about choosing the type of surgery, DHCA time and nadir body temperature are crucial. Inexperienced surgeons may benefit from hemiarch surgery because they can save surgery time and avoid more severe platelet dysfunction due to hypothermia. The timing and types of surgery for AD patients received APT remains to be further explored.

Any form of malperfusion of ATAAD(Penn class b) will greatly extend the length of hospital stay in the intensive care unit and double the surgical mortality [25]. The majority of patients enrolling in this study showed absence of branch vessel malperfusion or circulatory collapse after PSM. There was no difference of postoperative surgery-related stroke, renal failure. The non-APT group has a longer ICU residence time, and we speculate that it may be due to the different protocols of different centers. We have measured the ICU stay time in our department and there is no difference between the two groups.

There are some limitations in the present study. It was a retrospective multiple-centers study and selection bias may have occurred. However, by using PS matching, we think the results are convincing and significant. PS matching is still not perfect. There are some factors that could not be matched completely and we have

to exclude many patients from non-APT group. Although we have no long-term follow-up, the previously reported long-term results are not related to more bleeding or blood transfusions [10]. Since surgeons and anesthesiologists were aware of which patients have received APT before surgery, this might also cause deviations, which may affect the understanding of bleeding during the surgery and the willingness to use coagulants or tranfusion. We are not sure that due to the limited number of patients, the impact of APT on mortality is not a type II error. In addition, the current database also includes patients undergoing surgery to treat AD, and lost information about many patients who refused surgery.

Conclusion

In conclusion, our study has shown that only 1% of ATAAD patients received APT prior to surgery. Preoperative APT is associated with increased drainage, more transfusions, and higher mortality. Accurate diagnosis of ATAAD is important to avoid APT and reduce bleeding risk and mortality. The timing of surgery should be carefully considered based on the patient's status and the surgeon's experience. Further studies addressing the impact of APT in the high-risk AD patient population are still required, including separate analyses comparing the different platelet inhibitors and Penn classification.

Reference:

Tsai TT, Nienaber CA, Eagle KA. Acute aortic syndromes. Circulation. 2005; 112:3802-13.

1. Harris KM, Strauss CE, Eagle KA, Hirsch AT, Isselbacher EM, Tsai TT, et al. Correlates of delayed recognition and treatment of acute type A aortic dissection: the International Registry of Acute Aortic Dissection (IRAD). Circulation. 2011; 124:1911-8.
2. Deeb GM, Williams DM, Bolling SF, Quint LE, Monaghan H, Sievers J, et al. Surgical delay for acute type A dissection with malperfusion. Ann Thorac Surg 1997;64:1669—75.
3. Stevens LM, Madsen JC, Iseelbacher EM, Khairy P, MacGillivray TE, Hilgenberg AD, et al. Surgical management and long-term outcomes for acute ascending aortic dissection. J Thorac Cardiovasc Surg. 2009;138:1349—57.

1. Hansson EC, Geirsson A, Hjortdal V, et al. Preoperative dual antiplatelet therapy increases bleeding and transfusions but not mortality in acute aortic dissection type A repair. Eur J Cardiothorac Surg. 2019;56(1):182-188.
2. Hansen MS, Nogareda GJ, Hutchison SJ. Frequency of and inappropriate treatment of misdiagnosis of acute aortic dissection. Am J Cardiol 2007; 99:852–6.
3. Hansson EC, Dellborg M, Lepore V, Jeppsson A. Prevalence, indications and appropriateness of antiplatelet therapy in patients operated for acute aortic dissection: associations with bleeding complications and mortality. Heart 2013;99:116–21.
4. Zindovic I, Sjo"gren J, Bjursten H, Bjo"rklund E, Herou E, Ingemansson R, et al. Predictors and impact of massive bleeding in acute type A aortic dissection. Interact CardioVasc Thorac Surg 2017;24:498–505.
5. Chemtob RA, Moeller-Soerensen H, Holmvang L, Olsen PS, Ravn HB. Outcome after surgery for acute aortic dissection: influence of preoperative antiplatelet therapy on prognosis. J Cardiothorac Vasc Anesth 2017;31:569–74.
6. Hansson EC, Geirsson A, Hjortdal V, Mennander A, Olsson C, Gunn J et al. Preoperative dual antiplatelet therapy increases bleeding and transfusions but not mortality in acute aortic dissection type A repair. Eur J Cardiothorac Surg 2019; doi:10.1093/ejcts/ezy469.
7. Kim HO, Jin Y, Kickler TS, Blakemore K, Kwon OH, Bray PF. Gene frequencies of the five major human platelet antigens in African American, white, and Korean populations. Transfusion. 1995;35(10):863-7.
8. Augoustides JGT, Geirsson A, Szeto WY, Walsh EK, Cornelius B, Pochettino A et al. Observational study of mortality risk stratification by ischemic presentation in patients with acute type A aortic dissection: the Penn classification. Nat Rev Cardiol 2009;6:140.
9. Austin P C . Some Methods of Propensity-Score Matching had Superior Performance to Others: Results

of an Empirical Investigation and Monte Carlo simulations. Biometrical Journal, 2009, 51(1):171-184.
10. Fox KA, Eagle KA, Gore JM, et al. The global registry of acute coronary events, 1999 to 2009–Grace. Heart 2010;96:1095-101.
11. Moulton MJ, Creswell LL, Mackey ME, et al. Reexploration for bleeding is a risk factor for adverse outcomes after cardiac operations. J Thorac Cardiovasc Surg. 1996;111:1037–46.
12. Spiess BD. Transfusion of blood products affects outcome in cardiac surgery. Semin Cardiothorac Vasc Anesth 2004;8:267–81.
13. Bertling A, Fender AC, Schu"ngel L, et al. Reversibility of platelet P2Y1 inhibition by platelet supplementation: ex vivo and in vitro comparisons of prasugrel, lopidogrel and ticagrelor. J Thromb Haemost 2018;16:1089–98.
14. Zindovic I, Sjogren J, Ahlsson A, Bjursten H, Fuglsang S, Geirsson A et al. Recombinant factor VIIa use in acute type A aortic dissection repair: a multicenter propensity-score-matched report from the Nordic Consortium for Acute Type A Aortic Dissection. J Thorac Cardiovasc Surg 2017;154:1852–9.e1852.
15. Scott WJ, Kessler R, Wernly JA. Blood conservation in cardiac surgery. Ann Thorac Surg 1990;50:843–51.
16. Mangano DT, Tudor IC, Dietzel C. The risk associated with aprotinin in cardiac surgery. N Engl J Med 2006;354:353–65.
17. Mossad EB, Machado S, Apostolakis J. Bleeding following deep hypothermia and circulatory arrest in children. Semin Cardiothorac Vasc Anesth. 2007,11(1):34-46.
18. Koster A, Sanger S, Knorig J, et al. Autologous plasma and platelet sequestration at the beginning of cardiopulmonary bypass: a pilot investigation in five patients undergoing extended vascular surgery in deep hypothermia. ASAIO J. 2002;48:106-109.
19. Augoustides JG, Szeto WY , Desai ND , et al. Classification of acute type a dissection: focus on clinical presentation and extent.Eur J Cardiothorac Surg. 2011 ;39(4):519-22.
20. Booher AM, Isselbacher EM, Nienaber CA, et al. The IRAD classification system for characterizing survival after aortic dissection. Am J Med 2013;126:730.e19- 24.
21. Girdauskas E, Kuntze T, Borger MA, Falk V, Mohr FW. Surgical risk of preoperative malperfusion in acute type A aortic dissection. J Thorac Cardiovasc Surg 2009;138:1363—9.**Legends:Figure 1.** The clinical outcome of patients diagnosed with acute type A aortic dissection (whether or not receiving APT therapy), patients who received antiplatelet therapy before surgery received more blood transfusions and have higher mortality. A, the clinical outcome of patients with or without APT, B, RBC, platelet and cryoprecipitate transfusion in patients with or without APT, C, plasma transfusion in patients with or without APT. APT (antiplatelet therapy), non-APT (non-antiplatelet therapy), MI (myocardial infarction), RBC (red blood cells).**Figure 2.** Distribution of propensity score across APT and non-APT groups. Treated (antiplatelet therapy), untreated (non-antiplatelet therapy),APT (antiplatelet therapy), non-APT (non-antiplatelet therapy). Table 1. Characteristics, operative differences and outcomes differences between APT group and non-APT group

Variables	Overall (%) N=1379	Before matching APT group (%) n=31	Before matching Non-APT group (%) N=1348	Before matching Standardized Difference	Before matching P-value	After matching APT group (%) N=30	After matching non-APT group (%) N=80	After matching Standardized Difference	Af ma P-
Age (Y) #	51.68±11.3	53.71±11.65	51.63±11.02	0.188	0.300	53.87±11.81	53.54±9.85	0.032	0.8
Males #	1119(81.1%)	29(93.5%)	1090(80.9%)	0.389	0.074	28(93.33%)	73(91.25%)	0.078	0.7
Hypertension #	1092(79.2%)	23(74.2%)	1069(79.3%)	0.121	0.488	22(73.33%)	58(72.5%)	0.019	0.9

Preoperative Renal Dysfunction #	42(3%)	3(9.7%)	39(2.9%)	0.291	0.030*	3(10%)	9(11.25%)	0.041	0.8
Smoking #	312(22.6%)	11(35.5%)	301(22.3%)	0.293	0.070	11(36.67%)	27(33.75%)	0.061	0.7
COPD	6(0.4%)	0(0.00%)	6(0.4%)	0.127	0.710	0(0%)	1(1.25%)	0.224	1.0
LVEF #	62.30±6.84	61.42±9.18	62.32±6.78	0.132	0.592	61.10±9.16	60.59±8.00	0.061	0.7
Preoperative platelets #	209.56±96.34	180.68±57.00	210.22±96.97	0.307	0.008*	181.90±57.56	169.79±70.26	0.181	0.4
History of PCI	65(4.7%)	11(35.5%)	54(4%)	1.145	0.000*	10(33.33%)	0(0%)	1.231	0.0
Body Surface Area(m2) #	1.72±0.26	1.71±0.44	1.72±0.25	0.039	0.925	1.87±0.35	1.75±0.21	0.470	0.0
Maximum aortic diameter(mm) #	45.31±8.68	43.97±9.48	45.34±8.66	0.158	0.385	44.43±9.27	45.86±8.59	0.163	0.4
Operation time (min) #	436.75±116.87	476.39±128.13	435.54±116.49	0.350	0.056	480.30±128.42	466.30±105.52	0.125	0.5
Perfusion									
Cardiopulmonary bypass time (min) #	201.85±64.34	212.39±70.51	201.60±64.20	0.168	0.356	213.07±71.61	214.09±65.65	0.015	0.9
Cross-clamp time (min) #	119.97±38.91	121.35±49.71	119.94±38.65	0.036	0.842	120.90±50.50	125.28±42.47	0.098	0.6
Hypothermic circulatory arrest time (min) #	18.70±7.29	22.39±13.38	18.62±7.08	0.518	0.128	21.50±12.65	20.04±7.0	0.164	0.5
Lowest temperature () #	23.24±1.94	21.22±1.28	23.28±1.93	1.073	0.001*	21.37±1.00	21.42±1.75	0.32	0.8
Transfusion									
pRBC (unit)	3.26±3.62	8.35±5.94	3.14±3.46	1.474	0.000*	8.40±6.05	2.76±3.64	1.277	0.0

Plasma (ml)	208.19±291.04	408.06±715.67	203.60±272.54	0.706	0.123	401.67±727.0	135.63±214.98	0.635	0.0
Platelet (unit)	9.82±8.12	13.94±8.8	9.72±8.08	0.521	0.004*	14.07±8.92	9.90±8.47	0.485	0.0
Cryoprecipitate (unit)	2.52±4.84	5.9±9.05	2.44±4.68	0.718	0.042*	5.77±9.17	4.07±5.80	0.247	0.3
APTT(s)	41.98±10.02	39.21±11.44	42.05±9.98	0.284	0.118	39.00±11.57	45.67±15.66	0.455	0.0
Drainage volume (ml)	3649.50±2581	4968.74±2107	3619.16±2684	0.705	0.004*	5009.37±2131	3408.38±2294	0.622	0.0
Re-operation	38(2.8%)	2(6.5%)	36(2.7%)	0.185	0.204	2(6.67%)	3(3.75%)	0.133	0.6
Cerebralvascular accident	92(6.7%)	4(12.9%)	88(6.5%)	0.219	0.160	4(13.33%)	8(10%)	0.10	0.6
Postoperative Renal failure	195(14.1%)	5(16.1%)	190(14.1%)	0.056	0.748	5(16.67%)	16(20%)	0.086	0.6
Spinal cord injury	12(0.9%)	0(0.00%)	12(0.9%)	0.190	0.598	0(0%)	3(0.75%)	0.173	0.5
Postoperative MI	53(3.8%)	3(9.7%)	50(3.7%)	0.246	0.087	3(10%)	3(3.75%)	0.254	0.3
Ventilation time (hours)	92.20±120.01	93.25±87.65	92.18±120.68	0.009	0.961	95.70±88.06	94.73±111.83	0.009	0.9
ICU length of stay (hours)	190.32±190.47	143.87±92.65	191.39±192.02	0.249	0.170	146.27±93.25	210.89±160.49	0.444	0.0
In hospital mortality	109(7.9%)	8(25.8%)	101(7.5%)	1.029	0.000*	8(26.67%)	8(10%)	0.442	0.0

COPD (chronic obstructive pulmonary disease), LVEF (left ventricle ejection fraction), PCI (percutaneous coronary intervention), APTT (activated partial thromboplastin time), pRBC (packed red blood cells), MI (myocardial infarction), ICU (intensive care unit). * P<0.05 versus APT group, #, variables using in PS matching.

Table 2. logistic regression analysis of in hospital mortality with PS matching patients

Preoperative Antiplatelet therapy	
Adjusted for aortic diameter, DHCA, nadir temperature,operative time, postoperative renal failure, stroke for PS matching	

Figure 1.

Figure 2

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