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Factors influencing early surgical outcomes of patients with acute aortic dissection type A

Фактори који утичу на ране хируршке исходе болесника са акутном дисекцијом аорте тип А

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Factors influencing early surgical outcomes of patients with acute aortic dissection type A

Фактори који утичу на ране хируршке исходе болесника са акутном дисекцијом аорте тип А

SUMMARY

Introduction/Objective Even with the current treatment mortality from aortic dissection remains high. The study aimed to evaluate the early postoperative outcome of patients with aortic dissection and identify which factors could have influence on it.

Methods The study included all consecutive patients who underwent surgery for acute aortic dissection type A from 2012 to 2017. We registered all parameters that could potentially impact the outcome (general data, medical history, clinical and cardiological diagnostic test findings, preoperative complications, type of cannulation and the operation performed, additional surgical procedures, operation duration, etc.). Patients were surgically treated according to the current protocols. The main outcome measures were complications and mortality during a one-month postoperative period. All data collected pre-, intra-, and postoperatively were compared and statistically analyzed.

Results The study included 246 patients, of an average 57.54+/-12.88 years of age and mostly male sex (74%). Early postoperative mortality occurred in 17% of patients. Preoperative chronic kidney insufficiency (p = 0.005) and cerebrovascular insult (p = 0.047) and tamponade (p = 0.036) were the major risk factors for postoperative complications and mortality. Long hypothermic cardiac arrest (p = 0.001), cross clamp (p = 0.017) and cardiopulmonary bypass time (p = 0.036) increased postoperative complications. Postoperative complications started occurring after ≥33.5 minutes hypothermic cardiac arrest and ≥67.5 minutes cross clamp time. Having more postoperative complications (p = 0.034) increased, while performing anterograde cerebral perfusion decreased the frequency of lethal outcome (p = 0.001).

Conclusion The majority of patients surgically treated for acute aortic dissection had good postoperative outcome. However, numerous pre-, intra- and postoperative factors can impact patient survival.

Key words: acute aortic dissection type A; surgery; outcome; risk factors

САЖЕТАК

Увод/Циљ Чак и уз тренутно лечење, смртност од дисекције аорте остаје висока. Циљ студије био је да се евалуира рани постоперативни исход болесника са акутном дисекцијом аорте тип А и идентификује који фактори могу утицати на њега.

Методе Студија је обухватила све узастопне болеснике оперисане због акутне дисекције аорте типа А од 2012. до 2017. Регистровали смо све параметре који могу потенцијално утицати на исход (општи подаци, историја болести, налази клиничких и кардиолошких дијагностичких тестова, преоперативне компликације, тип канулације и изведене операције, додатних хируршких поступака, трајање операције итд.). Болесници су хируршки лечени према важећим протоколима. Главне мере исхода биле су компликације и морталитет током једног месеца постоперативног периода. Сви подаци прикупљени пре, интра- и постоперативно упоређени су и статистички анализирани.

Резултати Студија је обухватила 246 болесника, просечне старости 57,54 ± 12,88 година и углавном мушког пола (74%). Рани постоперативни морталитет догодио се код 17% болесника. Преоперативна хронична инсуфицијенција бубрега (p = 0,005) и цереброваскуларни инсулт (p = 0,047) и тампонада (p = 0,036) били су главни фактори ризика за постоперативне компликације и морталитет. Дуго трајање хипотермичног срчаног застоја (p = 0,001), тоталне клеме (p = 0,017) и кардиопулмоналног бајпаса (p = 0,036) повећавали су постоперативне компликације. Постоперативне компликације почеле су да се јављају након ≥33,5 минута хипотермичног срчаног застоја и ≥ 67,5 минута времена тоталне клеме. Постојање више постоперативних компликација (p = 0,034) је повећавало, док је извођење антероградне церебралне перфузије смањивало учесталост смртног исхода (p = 0,001).

Закључак Већина болесника хируршки лечених због акутне дисекције аорте тип А је имала добар постоперативни исход. Међутим, бројни пре-, интра- и постоперативни фактори могу утицати на преживљавање болесника.

Кључне речи: акутна дисекција аорте тип А; операција; исход; фактори ризика

INTRODUCTION

Aortic dissection (AD) occurs as a result of direct mechanical force acting on the aortic wall (hypertension, hypervolemia, loss of laminar blood flow through the aorta) and damage to the aortic wall (connective tissue disorders, atherosclerotic changes) [1]. The worldwide incidence of acute AD ranges from 5 to 30 per million people [2, 3].

The survival and treatment outcomes of patients with acute AD type A have been continuously improving over the last decade [4]. However, even with the current treatment, due to potentially devastating complications, mortality from acute AD type A remains high. The most important and life-threatening complications of acute AD type A include lethal malperfusion syndrome, cardiac failure (myocardial infarction or cardiac tamponade) and stroke [5].

Numerous factors can impact the outcome of patients with surgically treated acute AD [1]. Some studies showed that the early survival of patients is affected by preoperative conditions like previous aortic valve replacement, migrating chest pain, limb ischemia, hypotension, shock, and cardiac tamponade. Additionally, long term survival is influenced by preoperative renal function impairment, reduced left ventricular ejection fraction and advanced age [5, 6].

The study goal was to investigate the early postoperative outcome of patients with acute AD type A, treated surgically in our referral cardio-surgery center. Moreover, we aimed to identify which factors, in terms of the patients' preoperative characteristics, intraoperative surgical parameters, and postoperative complications could influence patient outcome.

METHODS

The study included all consecutive patients who underwent surgery for acute AD type A at the Cardiac Surgery Department, Dedinje Cardiovascular Institute in Belgrade, from 01.01.2012 to 31.12.2017. We considered all parameters that could potentially impact the acute AD type A patients' outcome. The main/primary tested effect was lethal outcome and the

secondary indicator of the patients' condition was complications in the early postoperative period (30 days). So, we tested both which pre- and intraoperative parameters can cause postoperative complications, and how they all together impact patient survival. The study was approved by the Institutional Review Board. All patients signed informed consent for procedures and study.

Preoperatively, general data (age, sex, smoking status) and medical history were taken. We registered whether investigated patients had chronic illnesses and preoperative complications such as arterial hypertension (HTA) (pressure≥140/90mmHg), hyperlipoprotainemia (total cholesterol ≥4.5 mmol/L and low-density lipoprotein-cholesterol ≥2.5 mmol/L), cerebrovascular insult (CVI) previously or currently (ischemic stroke; transient ischemic attacks), periphery vascular disease (atherosclerosis except in aorta), chronic kidney insufficiency (albuminuria >30 mg/g; blood creatinine >133umol/L; glomerular filtration rate <60 ml/min/1.73m^2), heart tamponade, coronary illness (angina pectoris followed by acute coronary syndrome i.e. myocardial infarction and unstable angina), and other minor cardiological symptoms/complications (fatigue, shortness of breath, heart palpitations, chest pain, cold extremities) [5].

Upon admission for surgery, patients underwent a clinical and cardiology examination by transthoracic echocardiography (TTE) and multislice computed tomography (MSCT) for visualization of the dissection localization and measurement of the diameters of the ascending, descending and abdominal aorta. Only acute dissections of the type A (Stanford classification) were included in the study. Dissections were further divided into type I and II according to the DeBakey classification system. Finally, the EuroSCORE (www.euroscore.org) was determined for every patient.

The patients were surgically treated according to the current protocols for their condition (Bentall procedure; Interposition tube graft and resuspension of the aortic valve; Tirone David procedure; Hemiarch replacement and Arch replacement). The choice of operative technique for aortic reconstruction depended on the location of the primary endothelial tear [5]. In all cases, the open distal technique was performed in hypothermic cardiac arrest. Moreover, the primary entry resection was located and resected for all patients. We registered the type of cannulation and the operation performed. It was also noted if anterograde cerebral perfusion, aortocoronary bypass and intervention on the mitral valve were performed. Moreover, we

measured the deep hypothermic cardiac arrest time (DHCA) / hypothermic cardiac arrest time (HCA), cross clamp time and cardiopulmonary bypass (CPB) duration. The minimum DHCA temperature was 18^{o}C.

Postoperatively, the patients were followed up for one month. During that period all complications were registered, such as: acute myocardial infarction, CVI, spinal cord injury, paralysis, kidney insufficiency, pneumonia, other minor complications (prolonged intensive care; the need for intubation; revision of hemostasis; uncomplicated urinary infection; uncomplicated wound infection) and/or lethal outcome.

Statistical analysis

All data collected pre-, intra- and postoperatively were compared and statistically analyzed. The sample was portrayed by descriptive statistics (mean, standard deviation, frequency and percent). The Kruskal Wallis Hi square test was used to assess the differences in investigated parameters regarding postoperative outcomes. Receiver operating characteristics (ROC) analysis was used to find the cut-off operative time after which postoperative complications developed more often. Finally, we applied binary logistic regression to evaluate potential predictors of postoperative outcome in patients with acute AD type A. All investigated parameters were divided in two groups (preoperative and intra/postoperative) and in that manner used as dependent variables. We used SPSS 20 statistical software and 0.05 was the significance level.

RESULTS

The study included 246 acute AD type A patients who were on average 57.54 +/- 12.88 years old and were more often male (p = 0.001). There were no significant differences between patients regarding their smoking status (p = 0.610). The most common operation performed in these patients was graft interposition. The longest CPB time was 3.4 hours. At least one preoperative chronic illness / complication was registered in 84.55% of patients (p = 0.001).

Postoperative complications were also rather frequent (44.7%), but this finding was not significant (p = 0.097). Moreover, in the overall sample the outcome was good for the majority of patients (80.9%; p = 0.001).

Data collected pre- and intra- operatively and the postoperative outcomes of patients are presented in Tables 1-3. Differences in general, pre- and intra- operative data regarding postoperative outcomes are presented in Tables 4 and 5.

Out of all preoperative parameters only having chronic kidney insufficiency and tamponade on admission positively correlated with both early postoperative complications and lethal outcome. In addition, having CVI on admission was associated with postoperative complications, while more preoperative complications assessed together increased mortality in early postoperative period of patients with acute AD type A.

Performing anterograde cerebral perfusion decreased the frequency of lethal outcome while performing axilar cannulation and having early postoperative complications were associated with higher mortality. If duration of deep hypothermic cardiac arrest, cross clamp time and cardiopulmonary bypass time were longer patients had more early postoperative complications.

When we applied binary regression to investigate the association of the tested pre- and intraoperative parameters with lethal outcome in patients with acute AD type A, one significant model was obtained. Early postoperative mortality could be predicted using intraoperative (B = -1.450; Wald = 71.495; OR = 0.235; R^2 Nagelkerke = 0.191; p = 0.001; classification = 80.53%), but not preoperative parameters (p = 0.096). Lethal outcome can be expected more often in patients with more postoperative complications and when patients spent longer time on cross clamp (Table 6).

ROC analysis showed that DHCA time adequately explained 63.5% (p = 0.001), CPB time 57.6% (p = 0.052) and cross clamp time envisaged 59.6% (p = 0.014) of postoperative complications development (Figure 1). The cut-off for DHCA duration was 33.5 minutes (sensitivity = 65.3; specificity = 60.2) and for cross clamp time it was 67.5 minutes (sensitivity = 60.2; specificity = 59.3).

DISCUSSION

Acute dissection of the aorta is an urgent surgical condition that with high mortality due to the disease severity and the treatment complexity. Literature data show that as many as 50% of untreated patients with acute AD will die within the first 48 hours [2, 7]. Conversely, improvements in intraoperative management such as novel surgical techniques and postsurgical critical care have recently significantly improved the outcome for acute AD patients [4]. Nevertheless, even if patients are adequately surgically treated, in cases of severe acute AD type A the mortality is around 25% [3, 8]. In our sample, early postoperative mortality was 16.9%, which is rather high, but similar to other populations from the literature. A potential cause for the high mortality could be the fact that a high percentage of patients were rather metabolically unstable preoperatively. Some data showed that higher admission creatinine value and C-reactive protein serum levels increase mortality of patients with acute AD [9].

The most common causes of death in acute AD type A (80%) are rupture of the aorta in pericardium with consequent tamponade (or tamponade without visible rupture of the aorta) and myocardial ischemia [10]. Tamponade occurs in 8-10% of cases and is one of the gravest complications and the worst prognostic signs [11, 12]. In our study, tamponade was registered in a somewhat higher percentage (16.4%), most likely due to the prolonged time from dissection onset to hospitalization. We confirmed that having tamponade on admission was associated with adverse outcome of patients with acute AD type A.

Aortic insufficiency is also one of the preoperative complications of acute AD type A correlated with worse overall outcome [13]. In the literature, the incidence of aortic valvular insufficiency ranges from 41 to 76% of cases [11]. In our sample this percentage is slightly lower (31%) as we only investigated significant aortic insufficiency which required surgical treatment. We also did not prove that having significant aortic insufficiency preoperatively could increase adverse postoperative outcomes in patients with acute AD type A.

In some investigations nearly 80% of patients with acute AD had ischemic lesions on cerebral MSCT. If neurological disorders are found preoperatively, adverse postoperative outcomes seem to occur more often [4, 14]. Mortality of acute AD type A patients with neurological complications reaches 50% in case of further intra- and postoperative

complications. Still, patients with neurological deficits, with a favorable early postoperative course, usually recover fully [15]. In our study, preoperative neurological complications were not very frequent (around 7%), but having CVI on admission was associated with more postoperative complications.

Pre- and postoperative renal complications are risk factors for increased mortality in patients with acute AD type A [16]. The association between renal disease and worse cardiac surgery outcomes has multiple explanations [17]. Patients with kidney disease may have more extensive coronary disease preoperatively, along with other comorbidities. Besides, impaired renal function can be a direct risk factor for intra- and postoperative complications, due to the need for greater fluid infusions or blood transfusions [16, 17, 18]. Having chronic kidney insufficiency on admission in our study was associated with both early postoperative complications and lethal outcome.

The incidence of acute AD type A correlates with age and it mostly occurs in the 6th decade of life. Men are at higher risk of developing acute AD type A than women. However, women tend to present at an older age, with more advanced dissection, and more complications, and therefore have a higher early mortality rate [1, 5, 6]. In our study majority of patients were also males around the age of 57 years, but neither sex nor age were significantly associated with early morbidity or mortality.

Hypertension is considered to be the most important risk factor for acute AD and is present in about 80% of acute AD type A patients [1, 5, 6]. Patients with hypertensive disorders lasting 5 or more years before the occurrence of acute AD type A have adverse outcomes more often than normotensive patients. Smoking is another risk factor for developing AD [12, 19]. However, we did not confirm that smoking impacted the early postoperative outcome of patients with acute AD type A.

Some investigations found that the rate of acute AD type A progressively rises along with the increase in aortic diameter. Aortic complications mostly start developing once the aortic diameter reaches 60 mm [2, 10]. In our sample the average diameter of the ascending aorta was 53.65mm, while that of the descending aorta was 32.45mm. However, the aortic diameter was not associated with postoperative outcome.

Based on our results, no other preoperative patient characteristics and comorbidities were found affect the postoperative outcome of patients with acute AD type A. However, having more preoperative complications simultaneously did increase the rate of lethal outcome in the early postoperative period. One unexpected result was the fact that the EuroSCORE was not a significant predictor of outcome in our study. A possible explanation could be that our patients had few preoperative comorbidities that are assessed by EuroSCORE. Therefore, the average EuroSCORE was rather low in our study and consequently not sufficiently reliable for prediction. It seems that some other, not scored parameters and patient characteristic (perhaps biochemical and metabolic aspects) contributed to adverse outcome in our patients.

Treatment of acute AD type A continues to be challenging [2, 3]. Currently, different surgical techniques are being used for dissection treatment according to the indications, based on dissection type and patient condition. Adequate operative management remains the major concern for better outcome of acute AD type A patients [20, 21]. However, patients are completely different from one another, and numerous factors can impact the choice of technique and reflect surgical outcomes [22]. The results of our study show that, if appropriately chosen, the precise operation type was not a risk factor for postoperative morbidity and mortality.

Literature data show that aortic arch replacement was indicated in 12.2% of patients [12]. In our study, aortocoronary bypass, as a combined procedure with aortic reconstruction, was performed in 19.3% of patients. Studies indicate that early postoperative survival is equivalent when comparing antegrade and retrograde perfusion. Nevertheless, antegrade perfusion to the true lumen was associated with better long-term survival, while retrograde perfusion is a risk factor for late mortality [23, 24]. Our patients with antegrade perfusion also had better postoperative outcomes than those who underwent surgery without cerebral perfusion.

Currently, cannulation to establish cardiopulmonary bypass in patients with acute AD type A can be safely and efficiently performed through the femoral, subclavian, axillary artery, the ascending aorta, as well as through the left ventricular apex and the aortic valve [25, 26, 27]. Our results showed that axillar cannulation was associated with more frequent lethal outcome. A potential reason for this finding could be that patients who had axillar cannulation also had more preoperative chronic illness / complications, which might have influenced their overall outcome. Other authors also found that operative details differed significantly among

the patients with different cannulation sites [21, 23]. Other cannulation sites were found to be safe for our patients.

As expected, emergency operations were confirmed to have a significantly higher risk for both postoperative mortality and morbidity than elective acute AD surgery [2]. However, despite different novel surgical modifications, significant improvement in early mortality was not observed [9]. Moreover, no significant link between the overall early mortality and the extent of the aortic repair has been proven in literature [20]. Contrary, it was found that perioperative complications were associated with the length of cardiopulmonary bypass, which again increased complications and mortality after surgery [10, 21]. In this study, it was found for the first time that if DHCA duration was ≥33.5 minutes and cross clamp time was ≥67.5 minutes, postoperative complications were more likely.

Regression analyses performed in the literature suggest that the independent perioperative risk factors for adverse outcomes were prolonged cross clamp and cerebral perfusion time [4]. Prolonged cardiopulmonary bypass, surgery time and duration of deep hypothermia were the main intraoperative risk factors influencing surgical outcomes in patients who underwent aortic arch repair [20]. We found that performing the anterograde cerebral perfusion decreased lethal outcome. In addition, shortening the duration of DHCA, CPB and cross clamp time could reduce early postoperative complications. The obtained results should be confirmed on a larger sample in future for better reliability.

CONCLUSION

Our study shows that early 30-day mortality after surgery for acute aortic dissection type A remains high, affecting almost 17% of patients. Preoperative chronic kidney insufficiency, cerebrovascular insult and tamponade are the major factors that could lead to more postoperative complications and potential adverse outcomes. Lethal outcome can be expected more often in patients with cumulative postoperative complications, and when patients spend a longer time on a cross clamp. Moreover, we found that after 67.5 minutes of cross-clamp and 33.5 minutes of DHCA, postoperative complications occur more frequently.

Conflict of interest: None declared.

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Table 1. Descriptive data of the investigated patients with acute aortic dissection

Parameters	Minimum	Maximum	Mean	SD
Patients' age	16	86	57.54	12.88
Ejection fraction	25	65	54.56	7.87
Ascending aorta diameter – millimeters	30	90	53.65	9.69
Descending aorta diameter – millimeters	0	55	32.45	7.81
Abdominal aorta diameter – millimeters	2	61	25.16	11.99
EuroSCORE	2	18.45	7.69	3.75
EuroSCORE 2	0.24	65.47	8.52	8.37
EuroSCORE Log	1.2	38.47	13.65	8.86
Deep hypothermic cardiac arrest time – minutes	13	52	31.56	11.86
Cross clamp time minutes	53	192	64.43	7.52
Cardiopulmonary bypass duration – minutes	106	212	139.74	69.62

Table 2. General and preoperative acute aortic dissection patient data

Parameters		Frequency	%
Patients' sex	male	182	74
	female	64	26
Smoking status	not smokers	127	51.6
	smokers	119	48.4
Dissection type	one	213	86.6
	two	33	13.4
Marfan syndrome	no	227	92.3
	yes	19	7.7
Hypertension	no	75	30.5
	yes	171	69.5
Hyperlipoprotainaemia	no	205	83.3
	yes	41	16.7
Cerebrovascular insult before operation	no	229	93.1
	yes	17	6.9
Periphery vascular disease	no	226	91.9
	yes	20	8.1
Chronic kidney insufficiency	no	237	96.3
	yes	9	3.7
Coronary illness before operation	no	213	86.6
	yes	33	13.4
Tamponade on admission	no	183	74.4
	yes	63	25.6
Cerebrovascular insult on admission	no	226	91.9
	yes	20	8.1
Type 1/2 aortic regurgitation	no	124	50.4
	yes	122	49.6
Type 3/4 aortic regurgitation	no	175	71.1
	yes	71	28.9
Other symptoms and complications	no	213	86.6
	yes	33	13.4
Had some preoperative complications	no	38	15.4
	yes	208	84.6

Table 3. Intraoperative parameters and postoperative complications

Parameters		Frequency	%
Cannulation type	apical	129	52.4
	femoral	41	16.7
	axillar	76	30.9
Cerebral perfusion	no	124	50.4
	antegrade	122	49.6
Operation type	graft interposition	132	53.7
	Bentall	55	22.4
	David	4	1.6
	hemiarch	4	1.6
	graft + hemiarch	38	15.4
	Bentall + hemiarch	13	5.3
Intervention on mitral valve	no	231	93.9
	yes	15	6.1
Aortocoronary bypass	no	204	82.9
	yes	42	17.1
Postoperative myocardial infarction	no	241	98
	yes	5	2
Cerebrovascular insult postoperatively	no	214	87
	yes	32	13
Postoperative paralysis	no	243	98.8
	yes	3	1.2
Postoperative kidney insufficiency	no	217	88.2
	yes	29	11.8
Other postoperative complications	no	162	65.9
	yes	84	34.1
Had early postoperative complications	no	136	55.3
	yes	110	44.7
Lethal outcome (30-day mortality)	no	199	80.9
	yes	47	19.1

Table 4. Differences in preoperative parameters regarding postoperative outcomes

Parameters	Early postoperative lethal outcome (yes/no)		Early postoperative complications (yes/no)	
	KW χ^2	p	KW χ^2	p
Dissection type	0.648	0.421	1.071	0.301
Marfan syndrome	0.146	0.702	1.441	0.230
Hypertension	0.882	0.348	0.927	0.336
Hyperlipoprotainaemia	1.514	0.219	2.214	0.137
Cerebrovascular insult before	1.250	0.264	0.498	0.480
Periphery vascular disease	0.236	0.627	0.928	0.335
Chronic kidney insufficiency	7.998	0.005	4.114	0.043
Coronary illness before operation	0.021	0.885	0.008	0.927
Ejection fraction	1.783	0.182	0.301	0.583
Ascending aorta diameter mm	0.019	0.892	0.453	0.501
Descending aorta diameter mm	0.965	0.326	0.409	0.522
Abdominal aorta diameter mm	0.002	0.963	0.321	0.571
Tamponade on admission	4.487	0.036	2.921	0.087
Cerebrovascular insult on admission	0.487	0.485	3.906	0.047
Type 1/2 aortic regurgitation	1.428	0.232	0.827	0.363
Type 3/4 aortic regurgitation	0.041	0.840	0.045	0.833
Other preoperative complications/symptoms	1.198	0.274	0.218	0.640
Had some preoperative complications	4.607	0.034	0.123	0.725
EuroSCORE	0.824	0.364	3.143	0.076
EuroSCORE 2	0.156	0.693	0.842	0.359
EuroSCORE Log	0.053	0.818	0.515	0.473

Table 5. Differences in general and intraoperative data regarding postoperative outcomes

Parameters	Early postoperative lethal outcome (yes/no)		Early postoperative complications (yes/no)	
	KW χ^2	p	KW χ^2	p
Patients' age	1.248	0.264	0.001	0.971
Patients' sex	2.432	0.119	0.223	0.637
Smoking status	3.451	0.063	2.530	0.112
Cannulation type	12.981	0.001	1.714	0.190
Anterograde cerebral perfusion	11.977	0.001	0.392	0.531
Operation type	0.316	0.574	0.882	0.348
Intervention on mitral valve	0.588	0.443	0.143	0.705
Aortocoronary bypass	0.001	0.992	0.570	0.450
Deep hypothermic cardiac arrest time (minutes)	0.002	0.964	11.815	0.001
Cross clamp time (minutes)	0.131	0.717	5.690	0.017
Cardiopulmonary bypass duration (minutes)	0.956	0.328	4.439	0.036
Had early postoperative complications	8.552	0.003	/	/

Table 6. Significant model for prediction of acute aortic dissection operative outcome

Parameters		B	Standard error	Wald	p	OR
Operative model	Cannulation type	-0.014	0.007	3.823	0.051	0.986
	Arrest Time	-0.007	0.009	0.608	0.435	0.993
	Anterograde perfusion	0.675	0.447	2.277	0.131	1.964
	CPB duration	0.005	0.003	2.599	0.107	1.005
	Cross clamp time	0.541	0.239	5.111	**0.024**	1.718
	Operation type	0.095	0.107	0.799	0.371	1.100
	Aortocoronary bypass	0.060	0.531	0.013	0.910	1.062
	Intervention on MV	0.892	0.765	1.359	0.244	2.439
	Postop complications	1.469	0.417	12.428	**0.001**	4.343
	Constant	-3.373	0.708	22.668	0.001	0.034

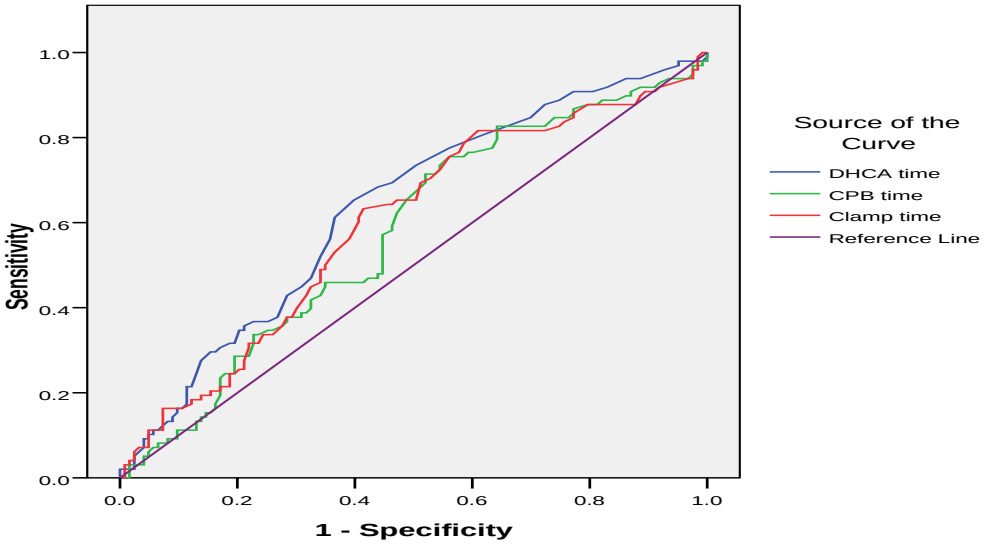

Figure 1. Receiver operating characteristics curve for postoperative complications based on operative times;

CPB – cardiopulmonary bypass; DHCA – deep hypothermic cardiac arrest time

