Results of Isolated Emergency Coronary Bypass Surgery According to Acute Coronary Syndrome

Akut Koroner Sendrom Tipine Göre Acil İzole Koroner Bypass Cerrahisinin Sonuçları

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ABSTRACT

Introduction: This study aims to evaluate the results of isolated emergency coronary bypass (CABG) according to acute coronary syndrome (ACS) types in a single center with 5-year experience.

Material and Methods: Totally, 138 patients who underwent emergency isolated CABG surgery from September 2009 to July 2014 in our hospital were enrolled in this retrospective descriptive study. The cohort was divided into four groups according to the type of ACS; 1: Unstable angina (n=14, 10.1%); Non-ST segment elevated myocardial infarction (n=43, 31.2%); 3: ST segment elevated myocardial infarction (n=65,47.1%); 4: Cardiogenic shock (n=16, 11.6%). There were 3 co-primary outcomes in the study: 1: in-hospital and 30-day mortality rate results; 2: mortality analysis according to subgroups; 3: to assess the performance of EuroScore II in patients with ACS who underwent emergency isolated CABG.

Results: No significant differences were observed between the groups in terms of demographic and preoperative risk factors. The observed 30-day total mortality rate was 15.9% (n=22). Mortality rates in the subgroups were 7% (n=1) in USAP, 4.65% (n=2) in NSTEMI, 15.38% (n=10) in STEMI and 68.75% (n=11) in the SHOCK subgroup, respectively. There was a significant difference in mortality between groups ($p<0.05$). The receiver operating characteristic curve value of EuroScore II was 0.890 (95% CI, 0.826-0.937).

Conclusion: The current study demonstrates that the observed mortality rate for STEMI and SHOCK patients requiring emergency CABG remains high. Moreover, Euroscore II has a good risk prediction in NSTEMI patients while significantly underestimates the mortality in the other groups.

Keywords: Acute coronary syndrome; Coronary artery bypass grafting; Dmergency surgery; outcome; Euroscore II

ÖZET

Giriş: Bu çalışmada, akut koroner sendrom (AKS) tiplerine göre izole acil koroner bypass (KABG) sonuçlarının tek merkezde 5 yıllık tecrübeyle değerlendirilmesi amaçlanmıştır.

Hastalar ve Yöntem: Eylül 2009 ile Temmuz 2014 yılları arasında acil izole koroner bypass yapılan toplam 138 hasta bu çalışmaya retrospektif yöntemle dahil edilmiştir. Kohort AKS tipine göre dört gruba ayrılmıştır; 1: Unstabil anjina (n=14, 10.1%); Non-ST segment yükselmeli miyokard infarktüsü (n=43, 31.2%); 3: ST segment yükselmeli miyokard infarktüsü (n=65,47.1%); 4: Kardiyojenik şok (n=16, 11.6%). Çalışmanın 3 esas amacı vardır; 1: Hastane içi ve 30 günlük erken mortalite sonuçlarının tespiti, 2: Alt gruplara göre mortalite oran analizi, 3: Acil izole KABG uygulanan AKS hastalarında EuroScore II'nin performansının değerlendirilmesi.

Bulgular: Gruplar arasında demografik ve preoperatif risk faktörleri açısından anlamlı fark bulunmadı. Gözlenen 30 günlük toplam mortalite oranı %15.9 (n = 22) idi. Alt gruplarda mortalite oranları sırasıyla; USAP'de %7 (n = 1), NSTEMI'da %4.65 (n = 2), STEMI'de %15.38 (n = 10) ve Şok alt grubunda %68.75 (n = 11) idi. Gruplar arasında mortalitede anlamlı fark vardı ($p<0.05$). EuroScore II'nin ROC değeri 0.890 (% 95 CI, 0.826-0.937) olarak tespit edilmiştir.

Sonuç: Bu çalışma, acil izole KABG gerektiren STEMI ve Şok hastalarında gözlenen ölüm oranının yüksek olduğunu göstermektedir. Ayrıca, Euroscore II NSTEMI hastalarında iyi bir risk öngörüsüne sahipken, diğer gruplarda mortaliteyi önemli ölçüde küçümsemektedir.

Anahtar Kelimeler: Akut koroner sendrom; Koroner arter bypas greftleme; Acil cerrahi; Euroscore II

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1. Introduction

Patients with acute coronary syndrome (ACS) requiring emergency coronary artery bypass grafting (CABG) represent a high operative risk that remains challenging for cardiac surgeons (1). While the percentage of patients undergoing emergency CABG have been decreasing recently, there is still a need for surgery in a significant group of patients (2).

Risk stratification and prediction models allow surgeons and institutions to compare surgical results objectively. They are also important in surgical decision making, providing accurate preoperative informed consent and enhancing the quality of health care (3). In addition, they help the patient and his caregivers to weigh the surgical risks and benefits and to build their expectations (4). Emergency CABG surgery is associated with a high mortality and morbidity, so prediction of mortality and morbidity is important in decision-making. Many risk evaluation systems for cardiac surgery have been developed. The European System for Cardiac Operative Risk Evaluation (EuroScore) is the most widely accepted and currently used model (5). There is a gap in the literature about EuroScore II's erroneous predictions in high risk and emergency CABG cases. Furthermore, there is limited data in literature regarding results of isolated CABG in patients with ACS.

The aim of this study was to evaluate the real world outcomes of emergency isolated CABG in patients presenting with ACS and to assess the performance of EuroScore II due to ACS subtypes.

2. Materials and Methods

This study was a cohort analysis of patients with an admitting diagnosis of acute coronary syndrome underwent isolated emergency CABG within 24h in a single center. Data were obtained using our institutional patient database. One hundred eighty-six patients underwent emergency coronary bypass surgery for ACS from September 2009 to July 2014. A retrospective study was performed in 138 of these 186 consecutive patients who had only isolated CABG. The patients excluded if they met any of the following criteria: concomitant cardiac procedure (e.g., valvular repair or replacement, aortic graft interposition) with CABG, presence of post-MI mechanical complications (e.g., free wall rupture, ventricular septal defect, ischemic mitral regurgitation, ventricular aneurysm), surgery not performed within 24 h, patients without ACS, lost to follow-up within 30 days after CABG.

All procedures were performed under cardiopulmonary bypass via median sternotomy. Emergency surgery was defined as a requirement for operation within 24h of presentation. Generally, a left internal mammarian artery (LIMA) graft was used for left anterior descending (LAD) coronary artery in hemodynamically stable patients and saphenous vein grafts was chosen for revascularisation at the surgeon discretion.

Indications for emergency CABG surgery were decided according to ACCF/AHA guidelines (6) were 1: lesions of the left main trunk or left main equivalant severe stenosis; 2: persistant angina which non-surgical treatment was ineffective; or 3: persistant angina for which percutaneous coronary intervention had been unsuccessful; 4: presence of persistant arrhytmia which medical treatment was inadequate.

ACS was defined as unstable angina (USAP), Non-STEMI (NSTEMI), ST-elevated myocardial infraction (STEMI) or cardiogenic shock (SHOCK), according to current guidelines (7,8).

The cohort was divided into four groups according to the type of ACS; 1: Unstable angina; 2: Non-ST segment elevated myocardial infarction; 3: ST segment elevated myocardial infarction; 4: Cardiogenic shock.

Preoperative factors examined were age, gender, type of ACS, rate of left ventricular ejection fraction, necessity for inotropes and intraaortic baloon pump, presence of chronic obstructive pulmonary disease, hypertension, diabetes mellitus, peripheral arterial disease, cerebrovascular disease, Euroscore II value, preoperative troponin, hemotocrit, creatinine, alanine transaminase and aspartate transaminase levels. Intraoperative factors investigated were cardiopulmonary bypass time, cross clamp time, types and number of grafts used. Postoperative variables were incidence of postoperative stroke, renal failure, necessity of hemodialysis, surgical site infection, bleeding amount, reoperation rate, left ventricular ejection fraction, in-hospital mortality, 30-day mortality, length of time supported by mechanical ventiation, duration of stay in intensive care unit (ICU), and postoperative length of hospital stay. The online tool was used to calculate the EuroScore II scores which is available on www.euroscore.org. Observed and expected mortalities were calculated with EuroScore II. The efficacy of risk model was analyzed in four subgroups. Values of the area under the receiver operating

characteristic (ROC) curve were calculated for Euroscore to evaluate the predictive power and accuracy in emergency isolated CABG patients.

Outcomes

There were 3 co-primary outcomes in this study: 1: in-hospital and 30-day mortality rate results; 2: mortality analysis according to ACS subgroups; 3: to assess the performance of EuroScore II in patients with acute coronary syndrome who underwent emergency isolated CABG.

Statistical Method

IBM SPSS Statistics (Ver. 22.0, SPSS Inc., Chicago, Illinois) software was used for statistical analysis. Results are given as mean ± standard deviation. Mann-Whitney U test was used for comparing quantitative data. Fisher's Exact test and Continuity Correction (Yates) test were used for analyzing qualitative data. Pearson's Chi-squared test was used to assess two types of qualitative comparisons. Receiver operating characteristic (ROC) curve was plotted and the area under the curve was determined. The sensitivity and specificity were calculated for EuroScore II. The results of the statistical tests were considered to be significant if $p<0.05$.

Ethics Statement

This study was approved by institutional ethics committee.

3. Results

3.1. Patient characteristics

138 patients (118 male, mean age 56.9±11.4 years) who underwent emergency isolated CABG for acute coronary syndrome were included to study. Patients were grouped according to etiology as follows: USAP (n=14, 10.1%), NSTEMI (n=43, 31.2%), STEMI (n=65,47.1%), SHOCK (n=16, 11.6%). No significant differences were observed between groups in terms of demographic, preoperative risk factors, or preoperative laboratory tests. The baseline demographic and clinical characteristics of patients were depicted in Table I. Patients with STEMI acute coronary syndrome underwent emergency CABG more often (47.1%) than the other patients. Cardiogenic shock was present in 11.6% of patients. The mean EuroScore II value was 6.5 ± 5.4 (Range:1.9-25.4).

3.2. Intraoperative data

The operative data was listed in Table II. All procedures were performed under CPB via sternotomy. The mean operative time was 220.2±66 minutes. While the mean CPB time was 107.3±44.3 minutes, the mean cross-clamp time was 61.2±25.5 minutes. Complete revascularization was achieved in all patients. The mean number of distal anastomoses was 2.6±0.9. LIMA graft was used in 65.2 percent (n=90) of cohort. There was a significant difference in mortality between LIMA using. While 91.1% (n=82) of patients were survived who had LIMA graft, the mortality rate was 33.3% in patients who had not LIMA graft ($p<0.001$).

3.3. Postoperative data

Data about postoperative course was summarized in Table III. The mean LVEF was found higher according to perioperative period (47.8±11 vs. 42.9±9.4). A total of 84.7 percent of patients (n=117) received transfusion postoperatively. The mean ICU stay was 3.6 days and hospital stay was 9.6 days. In fourteen patients (10.6%) a re-operation was needed because of bleeding. Postoperative stroke was observed as 3.1% in our emergency CABG population. The most common complication was the pulmonary problems (n=23, 18%) in the postoperative course.

3.4. IABP and inotropic support

In 7.2% (10/138) of patients, an IABP was implanted before emergency CABG, and in 38.4% (53/138), an IABP was inserted after myocardial revascularization in the intra-or postoperative period. Overall, 45.6% (n=63) of patients received IABP support. A total of 91 patients (65.9%) were treated with inotropic support. Patients who presented with STEMI or cardiogenic shock or who needed preoperative IABP or inotropic support were more likely to die ($p<0.001$).

3.5. Mortality analysis

In the entire cohort, the mean observed 30-day total mortality rate was 15.9% (n=22), whereas the total mortality was 17.4% (n=24). Mortality rates in the subgroups were 7% (n=1) in USAP, 4.65% (n=2) in NSTEMI, 15.38% (n=10) in STEMI and 68.75% (n=11) in the SHOCK subgroup,

respectively. There was a significant difference in mortality between groups, Chi-squared test showed that the patients in SHOCK group were likely to die than the other patients ($p<0.001$). No statistically significant difference was found between gender (female 15%, n=3; male 17.7%, n=21; $p>0.05$) acccording to mortality.

3.6. Risk score evaluation

The calculated mean score for EuroScore II was 6.51 ± 5.44 (Range:1.9-25.4). The mean score of EuroScore II of patients who died were significantly higher than survivors ($p<0.01$). Expected and observed mortality analysis is shown in Table IV. The observed mortality rates were significantly increased as the calculated risk increased ($p<0.001$). A ROC curve was plotted for the Euroscore II. The area under the receiver operating characteristic curve (AUC) value was calculated for predictive power and accuracy of Euroscore II. The AUC value of EuroScore II was 0.890 (95% CI, 0.826-0.937) (Figure 1). In the analysis of ROC curve results, a good risk prediction was observed using EuroScore II in NSTEMI group, however EuroScore II significantly underestimated the mortality in the STEMI and SHOCK groups.

4. Discussion

Emergency CABG in patients with ACS is associated with increased morbidity and mortality. In our study, the main findings were that emergency CABG in patients with ACS was an effective procedure which has various outcomes in the early clinical course according to ACS type. However, the mortality in STEMI and cardiogenic shock were higher than expected in cohort. Currently, surgical mortality in patients who underwent emergency CABG for acute coronary syndrome varies between 5-20% (9-12). Reasons for these highly variable mortality rates are: the multi-centricity of the studies, the different experience levels in centers and different selection criteria of patients. Khaladj et al. analyzed 127 patients (NSTEMI; n=86; 68%, STEMI; n=41; 32%) who underwent emergency CABG and reported an overall mortality rate of 6%, and 15% in the STEMI group (10). In our study, the 30-day overall mortality rate was 15.9% and total mortality was 17.4%. Patient selection was one of the main reasons for the gap between our mortality rates because 58.9 percent of our cohort had STEMI or

cardiogenic shock. Danner et al. reported an even higher mortality rate of (18.3%) in a study of 109 emergent CABG cases (39.4% had STEMI and 15.6% had SHOCK) (11). Constance et al. examined 985 patients who underwent emergency CABG and they reported a rate of mortality as 16.3%. In addition, reoperation was performed in 14.1% of the cases and stroke was observed in 3.2% of patients (12). Similar postoperative compication rates were seen in our study. In the SHOCK trial, White et al. performed a study to compare outcomes of acute MI complicated by cardiogenic shock. The 30-day mortality rate was 57% in the emergency CABG group (13). These data were correlated with the results of our study.

Our results regarding number of grafts was used in emergency CABG was similar to previous studies (14). Concerning the use of LIMA graft, various results have been reported (2,10). In our study, we found that use of LIMA (65.2%) was higher than reported (58.2%) papers. As well known, arterial grafts have higher long-term patency rates than saphenous grafts. We recommend that if patients have a stable hemodynamic status, LIMA graft should be selected for LAD instead of saphenous vein graft.

Some studies reported that EuroScore II underestimates mortality rates of high-risk cardiac surgery, whereas others reported that it overestimated the risk (15-17). However, Kunt et al. compared risk prediction and they reported that EuroScore II was significantly underestimated (observed overall mortality: 7.9%, predicted mortality: 1.7, p=0.001) mortality risk for coronary surgery (15). Barili et al. noted that the predictive power of EuroScore II is similar to the older risk stratification models. Moreover, no superiority was found in the high risk patient group (16). Grant et al. aimed to assess the performance of EuroScore and they reported that it was demonstrated poor calibration and comparatively poor discrimination for emergency cardiac surgery (17). In our study, we evaluated the efficiency of the EuroScore II for predicting the mortality in emergency isolated CABG operations. The area under the curve was 0.89 (95% CI: 0.826-0.937). Generally, EuroScore II underestimated and failed to predict the mortality of emergency isolated CABG cases, it could predict the mortality only in NSTEMI patients.

Recently, Slottosch and co-workers reported that preoperative IABP support does not give any additional clinical benefit on patients undergoing CABG for ACS (18). In our study period, 7.2

percent of patients had an IABP was implanted before emergency CABG, and 38.4 percent had IABP after myocardial revascularization in the intra-or postoperative period. Overall, 45.6% of patients received IABP support. However, we observed that, IABP has a valuable effect on clinical course and hemodynamic parameters in patients with ACS underwent emergency CABG.

Limitations

This study is limited by the fact that it is retrospective in nature and reflects the experience of a single center. Also, our results are limited to in-hospital events, and follow-up outcomes on midterm and long-term survival are not available. Finally, this study included a relatively small sample size.

5. Conclusion

Emergency surgical revascularization of patients presenting with acute coronary syndrome is achievable and results in good outcomes in NSTEMI patients. Mortality in STEMI patients, especially in cardiogenic shock is significantly high. In addition, risk prediction of Euroscore II was admissible in NSTEMI patients, whereas, it significantly underestimated the mortality in the other patients who underwent emergency CABG presenting with ACS.

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Conflict of interest

None to declare

6. References

1. Solodky A, Behar S, Boyko V, Battler A, Hasdai D. The outcome of coronary artery bypass grafting surgery among patients hospitalized with acute coronary syndrome: the Euro Heart Survey of acute coronary syndrome experience. Cardiology. 2005;103(1):44-7.
2. Maganti M, Brister SJ, Yau TM, Collins S, Badiwala M, et al. Changing trends in emergency coronary bypass surgery. J Thorac Cardiovasc Surg. 2011 Oct;142(4):816-22.
3. Ferraris VA, Ferraris SP. Risk stratification and comorbidity. In: Cohn LH, Edmuns Jr, editors. Cardiac surgery in the adult. 2nd ed. New York: McGraw-Hill; 2003. P.187-224.
4. Au WK, Sun MP, Lam KT, Cheng LC, Chiu SW, et al. Mortality prediction in adult cardiac surgery patients: Comparison of two risk stratification models. Hong Kong Med J 2007; 13(4): 293-7.
5. Nashef SA, Roques F, Sharples LD, Nilsson J, Smith C, et al. EuroSCORE II. Eur J Cardiothorac Surg. 2012; 41: 734-44.
6. 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation 2011; 124:2610-42.
7. Pilarczyk K, Boening A, Jakob H, Langebartels G, Markewitz A, et al. Preoperative intra-aortic counterpulsation in high-risk patients undergoing cardiac surgery: a meta-analysis of randomized controlled trials. Eur J Cardiothorac Surg. 2016 Jan;49(1):5-17.
8. Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Rev Esp Cardiol (Engl Ed). 2017 Dec;70(12):1082.
9. Coumbe A, John R, Agirbasli M, McFalls E. Variation of Mortality After Coronary Artery Bypass Surgery in Relation to Hour, Day and Month of the Procedure. BMC Cardiovascular Disorders 2011,11:63.

10. Khaladj N, Bobylev D, Peters S, Guenther S. Immediate Surgical Coronary Revascularisation in Patients Presenting With Acute Myocardial Infarction. J Cardiothorac Surg. 2013 Jul 3;8: 167.
11. Danner Bernhard C, Didilis V, Stojanovic T, Popov A. A Three-Group Model to predict Mortality in Emergent Coronary Artery Bypass Graft Surgery. Ann Thorac Surg. 2009; 88:1433-9.
12. Constance K, O'Brien S, Edwards F, Peterson E, Ferguson B. Trends in Emergency Coronary Artery Bypass Grafting After Percutaneous Coronary Intervention. Ann Thorac Surg 2006; 81:1658-65.
13. White H, Assman S, Sanborn T, Jacobs A, Webb J, et al. Comparison of Percutaneous Coronary Intervention and Coronary Artery Bypass Grafting After Acute Myocardial Infarction Complicated by Cardiogenic Shock. Circulation. 2005;112:1992-2001.
14. Yang EH, Gumina RJ, Lennon RJ, Holmes DR Jr, Rihal CS, et al. Emergency coronary artery bypass surgery for percutaneous coronary interventions: changesin the incidence, clinical characteristics, and indications from 1979 to 2003. J Am Coll Cardiol. 2005 Dec 6;46(11):2004-9.
15. Kunt AG, Kurtcephe M, Hidiroglu M, Cetin L, Kucuker A, et al. Comparison of original EuroSCORE, EuroSCORE II and STS risk models in a Turkish cardiac surgical cohort. Interact CardioVasc Thorac Surg. 2013; 16 (5): 625-9.
16. Barili F, Pacini D, Rosato F, Parolari A. The role of surgical procedures on discriminative performance of the updated EuroScore II. J Thorac Cardiovasc Surg. 2013 Oct; 146(4):986-7.
17. Grant SW, Hickey GL, Dimarakis I, Cooper G, Jenkins DP, et al. Performance of the EuroScore models in emergency cardiac surgery. Circ cardiovasc Qual Outcomes. 2013 Mar 1;6(2):178-85.
18. Slottosch I, Liakopoulos O, Scherner M, Kuhn E, Deppe AC, et al. Preoperative intraaortic balloon pump before urgent coronary bypass grafting. Asian Cardiovasc Thorac Ann. 2018 Jun;26(5):353-360.

Abbreviations and Acronyms

ACS= Acute coronary syndrome

AUC = Area under curve

CABG = Coronary artery bypass grafting

CI= Confidence interval

LAD= Left anterior descending artery

MI= Myocardial infarction

ROC= Receiver operating characteristic

USAP= Unstable angina pectoris

NSTEMI= Non-ST-elevated myocardial infarction

STEMI= ST-elevated myocardial infarction

LVEF= Left ventricular ejection fraction

TABLES

Table I: Demographical and preoperative clinical parameters of patients *(n=138)*

Parameters		**Min-Max**	**Mean ± SD**
Age		19-84	56.9±11.4
Preoperative LVEF *(%)*		20-65	42.9±9.4
Troponin level *(ng/ml)*		0-50	5.8±12.8
Hemotocrit *(%)*		23-54	40.3±5.6
Creatinine *(mg/dL)*		0.3-3.2	0.94±0.3
ALT *(U/L)*		3-164	31.8±20.4
AST *(U/L)*		5-258	51.4±49.7
		n	**%**
Gender	Female	20	14.5
	Male	118	85.5
Type of ACS	USAP	14	10.1
	NSTEMI	43	31.2
	STEMI	65	47.1
	SHOCK	16	11.6
Risk Factors	Chronic Lung Disease	10	7.2
	Hypertension	62	44.9
	Extracardiac arteriopathy	4	2.8
	Renal impairment	5	3.6
	Dialysis	2	1.4
	Diabetes on insulin	25	18.1
	Neurological Dysfunction	3	2.2
	Pulmonary Hypertension	5	3.6
	Smoking	101	73.2

LVEF: Left ventricular ejection fraction; ALT: Alanine transaminase; AST: Aspartate transaminase; *ACS: Acute coronary syndrome; USAP: Unstable angina; NSTEMI: Non-ST segment elevated myocardial infarction; STEMI: ST segment elevated myocardial infarction; SHOCK: Cardiogenic shock*

Table II: Operative features of patients

		Min-Max	Mean±SD
Time of operation *(min)*		120-490	220.2±66
CPB *(min)*		23-305	107.3±44.3
Cross-Clamp *(min)*		10-123	61.2±25.5
		n	**%**
IABP	**Yes**	10	7.2
	No	128	92.8
Inotrope	**Yes**	29	21.2
	No	109	78.9
Number of grafts	**1**	13	9.4
	2	51	37
	3	45	32.6
	4	23	16.7
	5	6	4.3
Mamarian graft	**Yes**	90	65.2
	No	48	34.8
SVG	**0**	9	6.5
	1	35	25.4
	2	46	33.3
	3	40	29
	4	5	3.6

CPB: Cardiopulmonary bypass; IABP: Intraaortic baloon pump; SVG: Saphenous vein graft

Table III: Post-operative parameters of patients

		Min-Max	Ort±SS
Drainage *(cc)*		100-2200	659±357
Time to Extubation *(h)*		4-360	14.4±32.6
Daily urine output *(cc)*		2000-5902	3386.7±796.6
EF *(%)*		20-65	47.8±11
Creatinine ***(mg/dL)***		0.4-1.9	0.97±0.2
Hemotocrit ***(%)***		21-48	29.3±4
ALT *(U/L)*		5-648	50±69
AST *(U/L)*		21-1022	141.1±162.6
ICU stay *(days)*		1-42	3.6±5.5
Stay of hospital *(days)*		4-61	9.67±7
		n	**%**
IABP	**Yes**	**43**	31.1
	No	**95**	68.8
Inotropic support	**Yes**	**91**	65.9
	No	**47**	34.1
Transfusion	**Yes**	**117**	84.7
	No	**21**	10.7
Hemofiltration	**Yes**	**1**	0.7
	No	**137**	99.3
Revision		14	10.6
Arrhythmia		17	13.2
Stroke		4	3.1
Respiratory insuffiency		23	18
Wound infection		10	7.8

ALT: Alanine transaminase; AST: Aspartate transaminase; EF: Ejection farction; ICU: Intensive care unite

Table IV: Expected and observed mortality analysis

Type of ACS	Expected Mortality (EuroScore II)	Observed Mortality
	Mean ± SD (Min-Max) %	%
USAP	3.1±0.6 (1.9-4.7)	7.1
NSTEMI	4.5±3.1 (2.2-21.1)	4.6
STEMI	5.7±3.8 (2.5-24.9)	15.3
SHOCK	17.7±4.5 (9.4-25.4)	68.7
Total	6.5±5.4 (1.9-25.4)	30-day: 15.9 Overall: 17.4

ACS: Acute coronary syndrome; USAP: Unstable angina; NSTEMI: Non-ST segment elevated myocardial infarction; STEMI: ST segment elevated myocardial infarction; SHOCK: Cardiogenic shock

Figure 1: Receiver operating characteristic curve for the EuroScore II