Original Article

Prediction of Short-Term Outcome after Primary Percutaneous Coronary Intervention by CADILLAC Risk Score

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Abstract:

Introduction: The CADILLAC risk score (CRS) has been developed and validated in the context of primary PCI as a reperfusion strategy for accurate risk stratification. Patients with low CRS have better outcome than those with intermediate to high CRS. However, further studies are needed to validate this score in our population.

Aim of the study: The present study was conducted to predict the short-term outcome after primary percutaneous coronary intervention (pPCI) by CRS.

Method: This prospective observational study was conducted at the National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh from March, 2019 to August, 2020, on 62 patients with two equally divided groups based on CRS: Group I with score 0-2 and Group II with e" 3. The score was calculated by summation of points gathered from each component of the score. Bleeding events, vascular access site complication, heart failure, cardiogenic shock, significant arrhythmia, major adverse cardiovascular and cerebrovascular events (MACCE), were observed during hospital stay and at 30-day follow up.

Result: Mean CRS of the groups were 0.45±0.85 and 4.71±1.74 respectively. Overall adverse outcome, both in-hospital and 30-day, were significantly higher in group II (12.9%vs.35%, p=0.003 and 0vs.22.6%, p=0.001 respectively). Heart failure (22.6%vs.6.5%, p=0.04; 19.4%vs.0, p=0.01) and MACCE (19.3%vs.3.2%, P=0.04; 16.1vs.0%, p=0.02) were significant during hospital stay and at 30-day follow up. Bleeding events (12.9%vs.0, p=0.03) and significant arrhythmia (6.5%vs.0, p=0.04) were significant during hospital stay. Length of hospital stay was also significantly shorter in group I (d"3days: 74.2%vs.35.5%; p= 0.01). The components of CRS except post-PCI TIMI (Thrombolysis in myocardial infarction) flow, intermediate to high CRS, male gender, diabetes mellitus, hypertension, were significant in univariate regression analysis. Moderate to high CRS (in-hospital and 30-day), left ventricular ejection fraction< 40% (in-hospital), triple vessel disease (30-day) were significant in multivariate analysis. ROC curve analysis showed, area under the curve for CRS was 0.745 (95% CI: 0.616-0.874; p=0.001). CRSe"3 predicted in-hospital outcome after pPCI with sensitivity and specificity of 35.5% and 87%, respectively.

Conclusion: In the setting of pPCI, low CRS is associated with better in-hospital outcome in comparison to intermediate to high CRS. Also, in comparison to intermediate to high CRS, low CRS is associated with better 30-day outcome after pPCI, However, for prediction of adverse short-term outcome after pPCI, CRS has got relatively low sensitivity and high specificity.

Key words: *P rimary PCI, CADILLAC risk score, Short term outcome, TIMI risk score, PAMI risk score.*

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Introduction:

The CADILLAC risk score was derived from the Controlled Abciximab and Device Investigation to Lower Late Angioplasty Complications (CADILLAC) trial database which comprises the largest and most comprehensive primary PCI database to date[1]. It consists of seven components: age >65years, Killip class II/III, anemia

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(Hemoglobin [gm/dl]: <13 for male, <12 for female) and renal insufficiency (creatinine clearance rate <60ml/min), triple vessel disease (TVD), ejection fraction (EF) <40%, post-PCI TIMI flow grade II/III. For each component point is 2 except Killip class II/III (3), renal insufficiency (3) and EF (4). Total point is 18. There is 3 strata of this risk score: low (0-2), medium (3-4), high (5-6). These seven clinical and angiographic parameters routinely collected and readily available at baseline or procedural

completion accurately predict 30-day and 1-year mortality rates after primary PCI and these all are integrated in this CADILLAC risk scoring system.[1]It is a simple risk score for predicting mortality and accurate risk stratification after primary PCI. Previous risk scores after reperfusion therapy have incorporated clinical with or without angiographic variables but have not considered baseline left ventricular function. Moreover, prior studies eg. Primary Angioplasty in MI (PAMI) score, Zwolle score have not been validated against independent databases or studies [1]It is found that, beside TIMI (Thrombolysis in Myocardial Infarction) risk score and PAMI (Primary Angioplasty in Myocardial Infarction) risk scores, CADILLAC risk score had high predictive accuracy for 30-day and 1-year mortality as well as for prediction of reinfarction at 30 days with slight superiority of the CADILLAC risk score.[2] It was shown that the CADILLAC risk score is an effective method of patient stratification for early discharge following primary PCI.[3] Predictive value of CADILLAC score was also shown for both primary PCI and rescue PCI.[4] The TIMI, PAMI, CADILLAC and GRACE showed an excellent predictive value for 30-day and 1-year mortality. In AMI patients treated with primary PCI, CADILLAC risk score accurately predict short- and long-term mortality. Of note, measurement of baseline left ventricular function is the single most powerful predictor of survival and should be incorporated into risk score models.

Objectives

a) General objective: To find out the predictive value of CADILLAC risk score for short-term of outcome after primary percutaneous coronary intervention.

b) Specific Objectives:

- To determine the CADILLAC risk score for risk stratification after primary percutaneous coronary intervention.
- To evaluate in–hospital outcome and to observe, estimate the length of stay in hospital after primary percutaneous coronary intervention.
- To observe the 30-day outcome of primary percutaneous coronary intervention PCI, after discharge.
- To find out the relationship between the CADILLAC risk score and the short-term outcome after primary percutaneous coronary intervention.

Methodology & Materials:

This was a Cross sectional, observational study and was carried out in the Department of Cardiology, National Institute of Cardiovascular Disease (NICVD), Dhaka, Bangladesh, over a period of one and half year from march 2017 to august 2018. The sample size was 62 and the study subjects were divided into 2 groups on the basis of CADILLAC risk score: Group I: Low risk group (score: 0 to 2)

Group II: Intermediate to high risk group (score e”3). Statistical analyses were performed using Statistical Package for the Social Sciences software by SPSS Inc., Chicago, IL, USA, version 16.0.

Inclusion criteria:

- STEMI patients undergoing primary PCI, admitted in the Department of Cardiology of NICVD during the study period.
- Age: e”18 years.
- Gender: Both male and female.

Exclusion criteria:

- Cardiogenic shock.
- Failed thrombolysis.
- Requirement of multi-vessel PCI or non-infarct related artery PCI during the index procedure.
- Bleeding diatheses.
- Known hepatic or renal dysfunction.
- Serious co-morbidities with a life expectancy of less than one year

Result:

This cross-sectional study was done in the department of cardiology, National Institute of Cardiovascular Diseases, Sher-E- Bangla Nagar, Dhaka, Bangladesh over a period of time from April, 2019 to August 2020. Sixty-two patients of acute STEMI were selected according to the selection criteria who were undergoing primary PCI. Study subjects were categorized into two groups on the basis of CADILLAC risk score. Group I (Low risk 0-2)

and Group II (Intermediate to high risk e" 3). The main objective of the study was to find out the predictive value of CADILLAC risk score with short- term outcome of acute STEMI patients undergoing Primary PCI. Predefined variables were studied and compared between the groups. Categorical variables were presented as percentages and analyzed using chi square test or Fisher's exact test as appropriate. Continuous variables were expressed as mean and standard deviation (SD) and analyzed using t-test. Variables that were found to be significant in the group analysis and a few variables that were confirmed to be significant in clinical practice were included in the multiple logistic regression analysis. All the statistical tests were 2-tailed, and a p<

0.05 was considered significant. All the analyses were carried out using SPSS statistical software version 16.

Table-I

Distribution of the study groups according to length of hospital stay (N= 62)

Hospital stay (days)	Group I (n = 31)		Group II (n=31)		Total (N=62)		p value
	Number	%	Number	%	Number	%	
≥4 days	8	25.8	20	64.5	28	45.2	
≤3 days	23	74.2	11	35.5	34	54.8	
Mean ± SD	3.1 ± 0.7		3.9 ± 1.0		3.5 ± 1.0		0.01[s]

Table-II

Univariate binary logistic regression analysis of determinants of adverse in-hospital outcome (N= 62)

Variables of interest	Regression coefficient (β)	p value	OR	95% CI of OR
Age>65 years	0.429	0.03[s]	1.53	1.019 – 4.827
Male gender	0.351	0.04[s]	1.37	1.089 – 3.910
Diabetes mellitus	0.612	0.04[s]	2.12	1.117 – 5.248
Hypertension	0.478	0.04[s]	1.48	1.007 – 4.212
Killip class II	1.217	0.03[s]	2.44	1.057 – 3.111
LVEF<40%	1.280	0.02[s]	3.01	1.247 – 5.210
CCR< 60 ml/min	0.701	0.03[s]	1.89	1.091 – 4.201
Hemoglobin	0.357	0.04[s]	1.43	1.044 – 5.394
TVD	1.969	0.03[s]	2.30	1.673 – 4.703
TIMI II flow	0.112	0.07[ns]	1.10	0.084 – 2.412
Intermediate to high CADILLAC risk score	1.312	0.01[s]	3.71	1.030 – 3.381

Table-III

Multivariate binary logistic regression analysis of determinants of adverse in-hospital outcome (N= 62)

Variables of interest	Regression coefficient (β)	p value	OR	95% CI of OR
Age>65 years	0.301	0.49[ns]	1.41	0.261 – 4.211
Male gender	0.041	0.66[ns]	1.01	0.147 – 5.100
Diabetes mellitus	0.410	0.09[ns]	1.99	0.247 – 4.347
Hypertension	0.801	0.29[ns]	2.41	0.520 – 3.312
Killip II	0.010	0.07[ns]	2.22	0.157 – 3.101
LVEF<40%	1.980	0.04[s]	3.55	1.047 – 4.200
CCR<60 ml/min	0.711	0.11[ns]	0.55	0.014 – 4.798
Hemoglobin	0.245	0.69[ns]	1.30	0.301 – 4.201
TVD	0.541	0.07[ns]	2.21	0.243 – 5.103
TIMI II	0.901	0.09[ns]	2.49	0.179 – 3.612
Intermediate to high risk score by CADILLAC	1.201	0.02[s]	3.30	1.020 – 5.281

Table-IV

Univariate binary logistic regression analysis for determinants of adverse 30-day outcome (N= 61)

Variables of interest	Regression coefficient (β)	p value	OR	95% CI of OR
Age>65 years	0.393	0.03[s]	1.51	1.028 – 3.217
Male gender	0.347	0.04[s]	1.35	1.079 – 3.280
Diabetes mellitus	0.600	0.04[s]	2.00	1.110 – 3.212
Hypertension	0.469	0.04[s]	1.42	1.017 – 3.581
Killip II	1.202	0.03[s]	2.29	1.049 – 4.222
LVEF< 40%	1.269	0.02[s]	2.91	1.159 – 5.247
CCR< 60 ml/min	0.692	0.03[s]	1.79	1.081 – 4.274
Anemia	0.344	0.04[s]	1.37	1.039 – 5.384
TVD	1.864	0.03[s]	2.24	1.247 – 5.001
TIMI II	0.109	0.12[ns]	1.07	0.064 – 4.241
Intermediate to high risk score by CADILLAC	1.312	0.01[s]	3.71	1.030 – 5.381

Table-V

Multivariate binary logistic regression analysis for determinants of adverse 30-day outcome (N= 61)

Variables of interest	Regression coefficient (β)	p value	OR	95% CI of OR
Age>65 years	0.379	0.14[ns]	1.51	0.264 – 5.201
Male gender	0.057	0.31[ns]	1.10	0.126 – 3.301
Diabetes mellitus	0.299	0.19[ns]	1.31	0.010 – 3.908
Hypertension	0.280	0.39[ns]	1.21	0.017 – 4.101
Killip II	0.251	0.41[ns]	1.08	0.049 – 4.169
LVEF< 40%	0.407	0.19[ns]	1.61	0.047 – 5.412
CCR< 60 ml/min	0.270	0.41[ns]	1.02	0.110 – 3.345
Anemia	0.152	0.48[ns]	1.12	0.121 – 4.201
TVD	1.110	0.04[s]	3.29	1.034 – 5.044
TIMI II	0.911	0.08[ns]	2.47	0.112 – 5.410
Intermediate to high CRS	1.120	0.02[s]	3.21	1.061 – 6.210

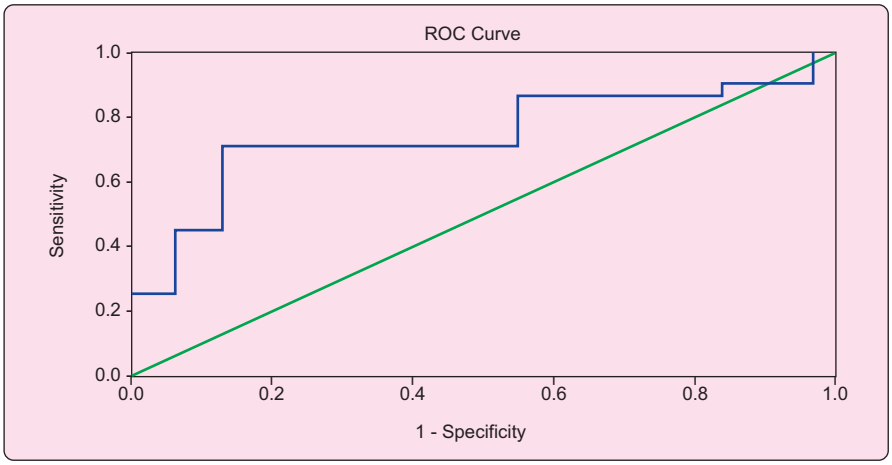

Fig.-1: *Receiver operating characteristic (ROC) curves for intermediate to high CADILLAC risk score (e" 3) for prediction of in-hospital outcome.*

Area Under the Curve

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.745	.066	.001	.616	.874

Discussion:

This prospective observational study was conducted in the Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka on selected acute STEMI patients who underwent primary PCI during their index hospitalization within the time period from march, 2019 to august ,2020. The primary objective of this study was to find out the predictive value of CADILLAC risk score (CRS) for short-term outcome after primary PCI. A total of 62 patients were included in the study. Patients were divided into two groups on the basis of CRS; patients with CRS 0-2 were categorized as group I and those with CRS e"3 were categorized as group II. Among the baseline characteristics of the study groups, age, gender, hypertension, diabetes mellitus, dyslipidemia, family history of premature coronary artery disease, Killip class, baseline left ventricular ejection fraction, hemoglobin level, creatinine clearance rate, triple vessel disease, differed between two groups. The components of the CRS except the post-PCI TIMI flow, male gender, hypertension, diabetes mellitus were found statistically significant. Sharkawi[2] in 2017 found similar result. Another study[1] found all of the components of CRS statistially significant. During hospital stay the observed adverse outcomes, were cardiogenic shock (9.7% vs. 16.1%), heart failure (6.5% vs. 22.6%), bleeding (0 vs. 12.9%), significant arrhythmia (0 vs. 12.9%), and MACCE (Major adverse cardiovascular and cerebrovascular accident) [3.2% vs. 19.3%] Comparison of the study groups revealed heart failure (p=0.04), bleeding events (p= 0.03) significant arrhythmia (p= 0.04) and MACCE (p= 0.04) were statistically significant. 1 patient died in group II (p= 0.31). Comparison of the study groups by overall adverse outcome (OAO) [12.9% vs. 35.5%, p= 0.03] was also statistically significant. Some study[2] found in hospital OAO significant (4 vs. 14%, p= 0.01). Mean length of hospital stay (LOS) in days was 3.5 ± 0 (3.1 ± 0.7 vs. 3.9 ± 1.0). Comparison of the study groups by mean LOS was statistically significant. 74% patients group I could be discharged within 3 days (74.2% vs. 35.5%). In One study[2] found mean LOS (2.99 ±1.0 vs. 3.77 ± 2.245) shorter and statistically significant. In another study[3] did not find mean LOS significant. At 30-day follow up, the observed adverse outcomes were cardiogenic shock (6.5%), heart failure (19.4%), significant arrythmia (6.5%), Bleeding (3.2%), MACCE (16.1%). All of these were observed in group II. Heart failure (p= 0.01) and MACCE (p= 0.02) were statistically significant. Two patients died in group II. Comparison of the study groups by overall adverse outcome (OAO) [0 vs. 12.6%, p= 0.01] was statistically significant. Some study[2] found OAO significant at day-3 or later (0 vs. 12%,

p= .002). On univariate logistic regression analysis, the components of CRS (except final TIMI flow), intermediate to high risk group of CRS, male gender, diabetes and hypertension were found statistically significant. Multivariate analysis showed intermediate to high CRS (both in- hospital and at 30-day follow up), LVEF < 40% (in-hospital) and TVD (at 30-day follow up) were the independent predictors of adverse outcome after primary PCI. The receiver operating characteristic (ROC) curve analysis of CADILLAC risk score, in predicting in-hospital outcome after primary PCI, was done in the present study. The area under the curve (AUC) for intermediate to high CADILLAC risk score (≥3) was 0.745 (95% CI: 0.616 – 0.874, p=0.001) with sensitivity and specificity of 35.5% and 87.1%, respectively. So, the main findings of this study describe that, the group with intermediate to high CADILLAC risk score is associated with adverse short-term outcomes especially bleeding events, significant arrhythmia, heart failure and MACCE in comparison to the group with low CADILLAC risk score.

Limitations of the study

Despite utmost efforts were made during carrying out this study, there were some limitations. The study sample size was relatively small. As purposive sampling was done so there could be a chance of selection bias. Study population was heterogeneous in terms of age, gender, time interval from symptom onset to hospital admission, blood sample collection, vascular access site, number of vessel involvement, vessel stented, and stent size. PCI was performed by multiple operators. So inter-operator variability might have affected the outcome. For identification of significant arrhythmia, patients were observed in CCU for 24 hours only, later it was diagnosed only by ECG on the basis of patient's complains, so some arrhythmias might be missed.

Conclusion and recommendations

In the setting of primary percutaneous coronary intervention, low CADILLAC risk score is associated with better in-hospital outcome in comparison to intermediate to high CADILLAC risk score. Also, In comparison to intermediate to high CADILLAC score, low CADILLAC risk score is associated with better 30-day outcome after primary percutaneous coronary intervention. However, for prediction of adverse short-term outcome after primary percutaneous coronary intervention, CADILLAC risk score has got relatively low sensitivity of 35.5% and high specificity of 87.1%.. Despite lower sensitivity, CADILLAC risk score may be used to predict short-term outcome after primary percutaneous coronary intervention. Larger scale, multi-centric studies should be carried out to validate the findings of the present study and if the result is concordant with future studies, it can be added to the existing armamentarium for prognostication in primary percutaneous coronary intervention.

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