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Study of CRUSADE bleeding score as a predictor of bleeding events in patients with acute coronary syndrome at a tertiary hospital

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Abstract

Background: Antithrombotic therapies represent a cornerstone in the management of patients with Acute coronary syndrome (ACS). The combination of clopidogrel with aspirin in acute coronary syndrome (ACS) patients has revealed repeatedly improved vascular outcomes. Present study was aimed to examine the value of CRUSADE bleeding score in predicting bleeding events in patients with acute coronary syndrome (ACS). **Material and Methods:** Present study was single-center, prospective, observational study, conducted in patients with ST Elevation Myocardial Infarction. The Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of the ACC/AHA Guidelines (CRUSADE)[6] score was calculated according to patients' hematocrit, creatinine clearance rate, heart rate, blood pressure, existence of heart failure, diabetes mellitus, and previous vascular diseases. **Results:** In present study, 102 patients of STEMI were studied. Mean age was 67.54 ± 10.43 years & majority were male (73.53 %). Mean baseline hematocrit was 39.93 ± 5.67 %. Mean creatinine clearance was 78.96 ± 47.88 ml/min. Mean heart rate was 81.6 ± 16.7 bpm. Mean systolic blood pressure was 137.5 ± 26.7 mm Hg. Signs of congestive heart failure (CHF) at presentation were noted in 9 patients (8.82 %). History of prior vascular disease was noted in 8 patients (7.84 %) & diabetes mellites was noted among 31 patients (30.39 %). 4 patients had evidence of major bleeding (3 had intracranial bleeding & 1 had documented retroperitoneal bleeding). Crusade score of >40 (mean score 55.41 ± 13.3) was observed in all cases. **Conclusion:** In patients with acute coronary syndrome, CRUSADE bleeding score > 40 can be considered as a predictor of bleeding events.

Keywords: acute coronary syndrome, CRUSADE bleeding score, predictor of bleeding events, thrombolysis

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Introduction

Cardiovascular disease is a major cause of death globally, and has overtaken infectious diseases as the primary cause of death in South Asia.[1] Acute coronary syndrome (ACS), including unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI)

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and ST-segment elevation myocardial infarction (STEMI), is one of the most frequent reasons for cardiac hospital admission.[2]

Antithrombotic therapies represent a cornerstone in the management of patients with ACS. The combination of clopidogrel with aspirin in acute coronary syndrome (ACS) patients has revealed repeatedly improved vascular outcomes.[3,4] However, the improvements come at the cost of elevated bleeding risk. Bleeding can deteriorate well-being and even survival following coronary artery bypass grafting (CABG); a potential subsequent need for blood transfusion can impact long-term mortality.[5]

Early risk stratification with the help of various risk scores can assist clinicians in determining appropriate pharmacologic therapies. Various bleeding risk scores were developed and tested. Among those, CRUSADE (Can Rapid risk stratification of Unstable angina patients Suppress Adverse outcomes with Early implementation of the ACC/AHA guidelines) used to predict the risk of bleeding as a complication of thrombolytic therapy in patients of Acute Coronary Syndrome.[6] Present study was aimed to examine the value of CRUSADE bleeding score in predicting bleeding events in patients with acute coronary syndrome (ACS).

Material And Methods

Present study was single-center, prospective, observational study, conducted in department of general medicine, at BKL Walawalkar Hospital, Chiplun, Ratnagiri, Maharashtra, India. Study duration was of 2 years (January 2021 to December 2022). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients of age > 18 years, either gender, with presence of typical chest pain, (retrosternal oppressive or compressive, which occurs at rest or with minimal exertion lasting for at least 10 min), electrocardiographic changes in the form of ST-elevation, or new T-wave inversion &/or positive cardiac enzymes according to the third universal definition of myocardial infarction, willing to participate in present study

Exclusion criteria

- Patients diagnosed with Non ST Elevation Myocardial Infarction.
- Patient on oral anticoagulants and patient, who died or discharged within 48 hours of admission.

Study was explained to patients in local language & written consent was taken for participation & study. All patients underwent detailed evaluation respect to onset of symptoms was noted followed by appropriate physical examination, laboratory investigations (CBC, LFTs, RFTs, serum electrolytes, cardiac troponin I), Complete 12-leads electrocardiography & echocardiography. Estimated glomerular filtration rate (eGFR) was calculated according to the Cockcroft–Gault formula.

The Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA Guidelines (CRUSADE)[6] score was calculated according to patients' hematocrit, creatinine clearance rate, heart rate, blood pressure, existence of heart failure, diabetes mellitus, and previous vascular diseases.

Table 1: CRUSADE bleeding score

Predictor	Range	Score
Baseline hematocrit (%)	31	9
	31–33.9	7
	34–36.9	3
	37–39.9	2

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	40	0
Creatinine clearance (mL/min)	<15	39
	15–30	35
	30–60	28
	60–90	17
	90–120	7
	120	0
Heart rate (bpm)	<70	0
	71–80	1
	81–90	3
	91–100	6
	101–110	8
	111–120	10
	121	11
Sex	Male	0
	Female	8
Signs of congestive heart failure (CHF) at presentation	No	0
	Yes	7
Prior vascular disease	No	0
	Yes	6
Diabetes mellitus	No	0
	Yes	6
Systolic blood pressure (mm Hg)	≤ 90	10
	91–100	8
	101–120	5
	121–180	1
	181–200	3
	≥201	5

All patients received received thrombolytic therapy with streptokinase in addition to double antiplatelet therapy (aspirin and clopidogrel) and enoxaparin. ST elevation MI patients who were thrombolysed and also given DAPT regimen post PTCA. Patients were closely monitored during the administration of thrombolytic agents.

The patients were followed up during their hospital stay, and various in-hospital events were such as mortality, in-hospital heart failure, cardiogenic shock, coronary revascularization; with either percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), Major bleeding events (intracranial bleeding, documented retroperitoneal bleeding, a fall in hematocrit of 12% from baseline, or any red blood cell transfusion in which baseline hematocrit was ≥28% or <28% with clinically documented bleeding) were documented. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Statistical analysis was done using descriptive statistics.

Results

In present study, 102 patients of STEMI were studied. Mean age was 67.54 ± 10.43 years & majority were male (73.53 %). Common cardiovascular risk factors noted were hypertension (61.76 %), Dyslipidemia (59.8 %), Diabetes (28.43 %) & Smoking (30.39 %). Significant medical history noted were of myocardial infarction (31.37 %), coronary angioplasty (10.78 %), CABG (7.84 %), prior vascular disease (7.84 %) & heart failure (6.86 %). On 2D echocardiography, mean ejection fraction was 58.12 ± 9.26 %. Coronary angiography by radial access was done among 73 patients (71.57 %).

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Table 1: Baseline characteristics

Demographic data	No. of patients / Mean ± SD	Percentage
Age (years)	67.54 ± 10.43	
Gender		
Male	75	73.53 %
Female	27	26.47 %
Cardiovascular risk factors		
Hypertension	63	61.76 %
Dyslipidemia	61	59.8 %
Diabetes	31	28.43 %
Smoking	29	30.39 %
Medical history		
Myocardial Infarction	32	31.37 %
Coronary angioplasty	11	10.78 %
CABG	8	7.84 %
Prior Vascular disease	8	7.84 %
Heart failure	7	6.86 %
Echocardiography		
Ejection fraction (%)	58.12 ± 9.26	
Coronary angiography (Radial access)	73	71.57 %

In present study, CRUSADE score characteristics were measured. Mean baseline hematocrit was 39.93 ± 5.67 %. Mean creatinine clearance was 78.96 ± 47.88 ml/min. Mean heart rate was 81.6 ± 16.7 bpm. Mean systolic blood pressure was 137.5 ± 26.7 mm Hg. Signs of congestive heart failure (CHF) at presentation were noted in 9 patients (8.82 %). History of prior vascular disease was noted in 8 patients (7.84 %) & diabetes mellites was noted among 31 patients (30.39 %).

Table 3: CRUSADE score data

Variable	No. of patients (%) / Mean ± SD
Baseline hematocrit (%)	39.93 ± 5.67
Creatinine clearance (ml/min)	78.96 ± 47.88
Heart rate (bpm)	81.6 ± 16.7
Systolic blood pressure (mm Hg)	137.5 ± 26.7
Signs of congestive heart failure (CHF) at presentation	9 (8.82 %)
Prior Vascular disease	8 (7.84 %)
Diabetes	31 (30.39 %)

In present study, 4 patients had evidence of major bleeding (3 had intracranial bleeding & 1 had documented retroperitoneal bleeding). Crusade score of >40 (mean score 55.41 ± 13.3) was observed in all cases.

Table 4: CRUSADE score

CRUSADE score	No major bleeding	Major bleeding
Extremely low risk (1-20)	21 (20.59 %)	0
Low risk (21-30)	46 (45.1 %)	0
Middle risk (31-40)	31 (30.39 %)	0
High risk (41-50)	0	2 (1.96 %)
Extremely high risk (>51)	0	2 (1.96 %)

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CRUSADE score	19.43 ± 10.35	55.41 ± 13.3

Discussion

Patients with acute coronary syndrome (ACS) are a heterogeneous population, with varying levels of risk for events, and so initial assessment has a crucial role in deciding the most appropriate therapeutic strategy.[7] In terms of recurrent ischemic and bleeding events, patients presenting with acute coronary syndromes (ACS) represent a diverse spectrum of clinical risk. Treatment of these patients includes antithrombotic therapy and invasive procedures, which carry an increased risk of bleeding, [8] the incidence of which ranges between 1% and 10%.[9]

Previously identified predictors of bleeding include advanced age, prior ischemic or hemorrhagic stroke, previous bleeding, hypertension, renal failure, female sex, lower weight, diabetes, atrial fibrillation, and a low hemoglobin (Hb) value.[10,11] The most common type of major bleeding is gastrointestinal (GI), and the most fatal is intracranial.[12]

Due to the strict correlation among bleeding, ischemic events, and mortality, more attention has been recently paid to the reduction of all avoidable iatrogenic hemorrhagic complications. The application of current therapies, including invasive management, based on risk is advocated by clinical guidelines. Several bleeding risk score models have been developed to define the patient risk profile and facilitate a personalized decision-making process.[6,13]

The Can Rapid Risk Stratification of Unstable Angina Pectoris Suppress Adverse Outcomes with Early Implementation of the ACC/AHA guidelines Quality Improvement Initiative (CRUSADE) was developed from a large retrospective database of high-risk patients with NSTE-ACS and estimates the patient's likelihood of a major bleeding event during admission.[6]

Bento D et al.,[14] conducted a single-center retrospective study of 2818 patients admitted with ACS, predictors of in-hospital major bleeding (IHMB) were determined. The IHMB rate was 1.8%, significantly lower than predicted by the CRUSADE score (7.1%, $p<0.001$). The incidence of IHMB was 0.5% in the very low risk category (rate predicted by the score 3.1%), 1.5% in the low risk category (5.5%), 1.6% in the moderate risk category (8.6%), 5.5% in the high risk category (11.9%), and 4.4% in the very high risk category (19.5%). The predictive ability of the CRUSADE score for IHMB was only moderate (AUC 0.73). The in-hospital mortality rate was 4.0%. Advanced age ($p=0.027$), femoral vascular access ($p=0.004$), higher heart rate ($p=0.047$) and ticagrelor use ($p=0.027$) were independent predictors of IHMB.

Mohamed M. et al.,[15] noted that CRUSADE bleeding score was the strongest predictor of major bleeding. Sensitivity of CRUSADE score ≥33 in prediction of major bleeding in the whole study group was 80%, specificity was 73.4%, positive predictive value was 26.9%, negative predictive value was 96.9%, overall accuracy was 74.1%. Sensitivity of CRUSADE score ≥38.5 in prediction of major bleeding in the STEMI patients was 70%, specificity was 84.8%, positive predictive value was 50%, negative predictive value was 92.9%, and overall accuracy was 82.1%.

External validation showed acceptable to good discrimination for the prediction of in-hospital major bleeding and the score was overall well calibrated across different study populations.[16] The CRUSADE score outperformed other scores in terms of predicting in-hospital major bleeding events.[17]

The ESC guideline on NSTE-ACS states that the use of the CRUSADE score may be considered in NSTE-ACS patients undergoing coronary angiography to quantify bleeding risk (class IIb, level of evidence B).[18] An almost three-fold greater risk of major bleeding was found in patients with high CRUSADE scores when treated with 24 months versus six months DAPT (9.7% vs. 3.7%; $p = 0.04$), while no significant differences were found in those with low or intermediate bleeding risk.[19]

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Identification of patients with a higher propensity for bleeding can lead to improvements in NSTEMI care by prompting clinicians to make judicious treatment selections, carefully dose antithrombotic medications, and select invasive strategies to optimize patient-centered care.[6] Among patients with ACS spectrum, CRUSADE risk score was able to identify patients at high bleeding risk, however future larger studies are required to focus on the implementation of various bleeding reducing strategies including the dosage adjustments of anticoagulants based on international normalized ratio (INR) and activated partial thromboplastin time (ApTT) value, using alternative therapy with less bleeding risk, correcting bleeding risk factors, if possible.

Conclusion

In patients with acute coronary syndrome, CRUSADE bleeding score > 40 can be considered as a predictor of bleeding events. CRUSADE risk score can be used to identify patients at high bleeding risk, play a crucial role in deciding the most appropriate therapeutic strategy at the initiation of therapy.

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