

# **Validity of GRACE Risk score to predict in- hospital mortality of acute coronary syndrome in CCU of AL-Yarmouk teaching hospital**

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## **Abstract**

**Background:** Patients with acute coronary syndrome (ACS) are liable to death during their hospitalization or thereafter. The Global Registry of Acute Coronary Events (GRACE) score is a simple tool that can predict mortality .

**Objective:** To predict the probability of in hospital death and also guides the appropriate treatment plan in acute coronary syndrome at the time of hospital admission.

## **Patients and methods**

150 patients with ACS admitted to Al- Yarmouk teaching hospital, Coronary Care Unit(CCU) from 1<sup>st</sup> of July 2017to 31th of January 2018, were included in this cross-sectional study, those with symptoms and signs compatible with ACS, by applying GRACE score which uses readily identifiable clinical parameters like :

cardiac arrest on admission, age of the patient ,heart rate, systolic blood pressure, Killip class, laboratory parameters like serum creatinine , elevated cardiac markers, and ST segment elevation. with follow up of patients during period of hospitalization.

## **Results**

Among 150 patients which presented in this study , 90 patients (60%) was male and 60 (40%) was female.

Patients were classified according to GRS, 30 patients (20%) were in low risk category, 55 patients(37%) were in intermediate risk category, 65patients(43%) were in high risk category. Out of 150 patients enrolled in the study, 26(8.5%) died during the period of admission, all of them in the moderate and large risk groups, There were significant difference in age, SBP and HR between the three risk groups of the study (Low, Intermediate, High) according to Grace score.

## **Conclusions**

Grace score is an easy method and an excellent tool to stratify patients and can prediction of in-hospital mortality for ACS patients and useful indicator to reinforce urgent intervention among high risk individuals to decrease mortality and complications during CCU admission.

## **Key Words:**

**GRACE risk score (GRS). Acute ST-segment elevation myocardial infarction (STEMI). Non-ST segment elevation myocardial infarction (NSTEMI). Acute coronary syndrome (ACS). Unstable angina (UA). In-hospital mortality.**

## **Introduction**

Acute coronary syndrome include patients with acute myocardial infarction with ST-segment elevation (STEMI) on their presenting ECG and those with non-ST-segment elevation ACS (NSTEMI-ACS). The latter include patients with non-ST -segment elevation myocardial infarction (NSTEMI), who, by definition, have evidence of myocyte necrosis, and those with unstable angina (UA), who do not. (1)

Most of these factors are modifiable either modifiable like hypertension, diabetes, smoking, hypercholesteremia, diet, physical inactivity or non modifiable like genetic ,age and sex, lifestyle

changes such as improved diet, smoking cessation, and increased physical activity can greatly reduce cardiovascular risk.<sup>(2)</sup>

Diagnosis of ACS can be done by (1) clinically, The patient with ACS typically complains of retrosternal pressure, squeezing, or heaviness that may be intermittent and recurrent or persistent. If the episodes are intermittent and recurrent, the duration of each episode may range from only a few minutes to several hour.

(2)ECG: UA and NSTEMI are associated with ST depression/transient elevation and/or T-wave changes; persistent ST elevation is characteristic of STEMI.

(3)Cardiac markers: like high sensitive Troponin I ,CK-MB typically obtained at baseline and at 4-6hrs and 12hrs after presentation.<sup>[3][4]</sup>

### **Risk stratification:**

Numerous risk scores have been developed but only a few of them have been used in practice. The most popular are the Platelet glycoprotein IIb/IIIa in Unstable angina: Receptor Suppression Using Integrilin Therapy (PURSUIT ), Thrombolysis in Myocardial Infarction risk scores (TIMI RS), and the Global Registry of Acute Cardiac Events risk score (GRACE). The GRACE score considered the most robust among several ACS risk prediction tools.(5)

The Grace risk score is more accurate because it was derived from a multinational registry of unselected patients and includes hospitals in Europe, Asia, north America, south America, Australia and New Zealand.(6)

GRACE was a collection of 10 -year research programme and the largest multinational study of ACS, the result is the Global Registry of Acute Coronary Events(GRACE).(7)

Risk assessment should be performed at the time of hospital admission as it gives an idea about probability of in hospital death and also potential benefits of identifying high risk category are excellent if proper intervention is done .(8)

The GRS uses eight baseline parameters, It includes: 1-age 2- heart rate 3- systolic blood pressure 4- Serum creatinine level 5- ST segment deviation in ECG 6- elevated serum cardiac marker 7- Killip class (refers to categorization of the severity of heart failure based on easily obtained clinical signs. The main clinical features are as follows: class I = no heart failure; class II = crackles audible halfway up the chest; class III = crackles heard in all the lung fields; class IV = cardiogenic shock) , 8-cardiac arrest at hospital admission (was defined as, ventricular fibrillation or asystole and requiring cardiopulmonary resuscitation from onset to admission).(9)

Regarding In-hospital mortality patient were classified to three groups according to GRACE risk score:

- **Low risk group having < 1 % mortality risk .**
- **Intermediate risk group having 1-9% mortality risk .**
- **High risk group having > 9% mortality (10) .**

Regulatory authorities such as the National Institute for Health and Clinical Excellence (NICE) and guideline groups (American College of Cardiology/American Heart Association [ACC/AHA] and European Society of Cardiology) recommend treatments according to specific clinical and risk grouping . (11,12)

### **Aim of study**

To predict the probability of in hospital death and also guides the appropriate treatment plan in acute coronary syndrome at the time of hospital admission .

### **Patients and methods**

150 Patients with ACS admitted to the CCU in Baghdad – Al Yarmouk teaching hospital in coronary care unit from 1<sup>st</sup> of July 2017 to 31 of January 2018. **were included in this cross-sectional study**, patients with symptoms and signs compatible with ACS (acute chest pain confirmed by elevated cardiac biomarker levels, and/or ischemic ECG changes) , were admitted to CCU and received standard treatment(including thrombolytic therapy in first12hours for STEMI) .

**Exclusion criteria :**

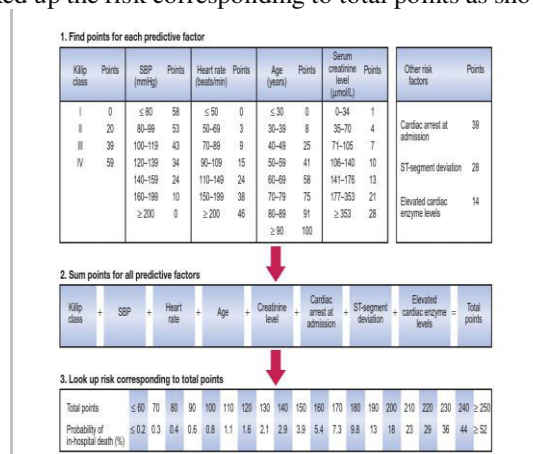
- (1) Those arriving CCU( after 12 hours or not receiving treatment according to the guideline.
- (2) Those with chronic angina, old myocardial infarction , valvular heart disease or alternative diagnosis.

Demographic and clinical data, including previous medical history and risk factors, were also documented .All included patients were subjected to assessment of risk factors, including ECG, complete blood count, lipid profile, blood sugar, blood urea, serum creatinine and history with thorough clinical examination including vital sign measurement, with follow up of patients during period of hospitalization.

**According to GRACE RS patients classify to :**

- **Low risk group having < 1 % mortality risk .**
- **Intermediate risk group having 1-9% mortality risk .**
- **High risk group having > 9% mortality risk.**

Patients form was taken from reference textbook.(10)The first step was filling the form for each patient. And then we looked up the risk corresponding to total points as shown in figure



**Statistical analysis**

Frequency distribution tables and graphs used to present the data, SPSS-24 computer software used for statistical analysis, Chi square test used to measure the association between the categorical variables, Independent sample t test and ANOVA (analysis of variance) used to measure the mean difference in continuous variables.

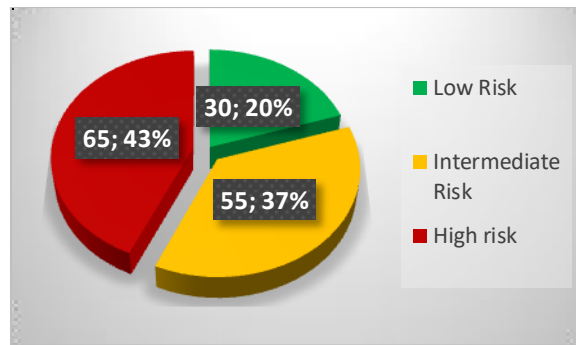
A confidence interval of 95% with a p value of less than 0.05 considered as significant.

**Limitation of study :** There were few important limitations of our study.

our sample size was comparatively smaller than other studies.

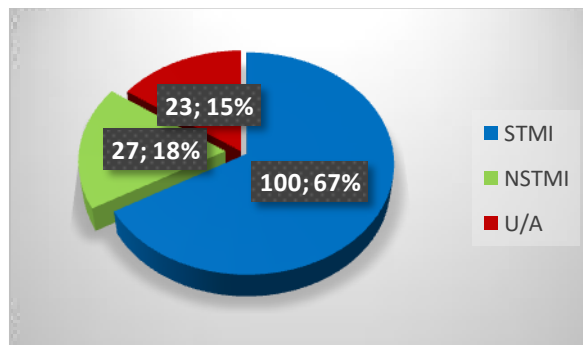
**Result**

Patients were classified according to GRS:30 patients (20%) were in low risk category, 55 patients(37%) were in intermediate risk category, 65patients(43%) were in high risk category as shown in.(Figure 1)



**Figure 1. GRACE Risk distribution within the sample (n 150).**

STEMI was found in 100( 67%) of cases while NSTEMI in 27 (18%) of cases and UA 23 (15%) of cases as shown in.(figure 2).



**Figure 2. Frequency distribution according to the presentation (n 150).**

**Table (1) showed that the:**

Age ranged from 30-80 years with statistical mean SD 57.94±11.24 years.

Heart rate ranged from 50 to 160 BPM with mean SD 97.43±27.79 BPM.

Systolic blood pressure ranged from 80 to 170 mmHg with mean SD 116,83±24.34mmHg.

Serum creatinine was ranged from 30 to 105 µmol/L with SD 61.23±13.76.

<b>Table 1.</b> Distribution of the continuous variables within the sample (n 150).			
Variable	Mean	±SD	Range
SBP (mmHg)	116.83	24.34	80 _ 170
Heart rate (BPM)	97.43	27.79	50 - 160
Age (years)	57.94	11.24	30 - 80
S. creatinine (µmol/L)	61.23	13.76	10 - 105

**Table 2.** Risk mortality distribution with parameters (n 150).

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Variables	Low risk (n 30)	Intermediate risk (n 55)	High risk (n 65)	P value
	Mean ± SD	Mean ± SD	Mean ± SD	
SBP (mmHg)	142.33 ± 18.03	126.18 ± 19.12	97.15 ± 12.24	<0.001 (*)
Heart Rate (BPM)	73.17 ± 15.61	80.45 ± 18.71	123 ± 14.30	<0.001 (*)
Age (years)	46.83 ± 7.13	54.93 ± 9.90	65.62 ± 7.93	<0.001 (*)
S. Creatinine (µmol/L)	59.83 ± 16.16	61 ± 10.01	62.08 ± 15.38	0.802 <sup>(NS)</sup>

(\*) Statistically significant at alpha level of less than 0.05.

There were significant difference in Age, SBP and HR between the three Risk groups of the study (Low, Intermediate, High) according to Grace score as shown in (Table 2). While there was no significant difference in S.Creatinine among these three categories P(0.802).

The study showed that In-hospital deaths is higher in high risk patient, 6 patients were dead in the intermediate risk group and 19 patients were dead in the high risk group, with (mostly in killip class III-IV), while none in low risk group as in . (Table 3) .

The study showed that In-hospital deaths is higher in high risk patient, 6 patients were dead in the intermediate risk group and 19 patients were dead in the high risk group, with (mostly in killip class III-IV), while none in low risk group as in . (Table 3) .

In this study ,age above 60yr s, heart rate >110bpm, SBP <100 mmHg, and killip class 3-4, cardiac markers elevated, ST segment deviation were highly significant to predict mortality as in.(Table 4) .

**Table 3.** Relationship between the mortality rate with risk level and Killip class (n 150).

Variables		Alive		Dead		Statistics
		N o.	%	N o.	%	
Risk	Low risk	30	100	0	0	X <sup>2</sup> = 14.7 P = 0.002(*)
	Intermediate risk	49	89.1	6	10.9	
	High risk	46	70.8	19	29.2	
Killip class	I	85	94.4	5	5.6	X <sup>2</sup> = 46.071 P = <0.0001(*)
	II	28	82.4	6	17.6	
	III	11	64.7	6	35.3	
	IV	1	11.1	8	88.9	

(\*) Statistically significant at alpha level of less than 0.05.

**Table 4.** Death rate distribution (n 150).

Variables	Alive (n 125)	Dead (n 25)	P value
	Mean ± SD	Mean ± SD	
SBP (mmHg)	121.16 ± 23.37	95.20 ± 16.43	<0.001(*)
Heart Rate (BPM)	94.12 ± 27.94	114 ± 20.46	<0.001(*)
Age (years)	56.97 ± 10.68	62.80 ± 12.83	0.017(*)
S. Creatinine (µmol/L)	60.72 ± 12.16	63.80 ± 20.11	0.309(NS)

**Discussion**

GRS is a good means to determine immediate as well as long term risk of mortality following ACS, as it demarcates high risk cases from low risk.(13)

In this study, high and intermediate RS that include 120 cases (80%) while low RS were 30 cases (20%), which incompatible with sabah et al(14) (67.25%) in low risk group and (32.75%) in intermediate and high risk group. regarding in-hospital Mortality were higher in the high-risk and intermediate-risk group, whereas no death in low risk group, which was compatible with Ekkhalak Koonsiripaiboon , Wiwun Tungsubutra et al,(15) and compatible with Rangamanikandan M, Shivcharan Jelia, Meena S. R, et al. only in high risk group(16)

In this study, age showed high association with mortality, like GRACE RS, which is compatible with sabah et al (14) and Rangamanikandan M, Shivcharan Jelia, Meena S. R et al (16).

We found study, increasing heart rate was increase risk of mortality. Like GRACE RS, incompatible with sabah et al (14), and compatible with Rangamanikandan M, Shivcharan Jelia, Meena S. R et al.(16)

The study showed, There were 67% STMI and 33% NSTMI/UA patients, which compatible with sabah et al (14), and Samar Firdous, Muhammad Amir Mehmood et al.(17).

In this study, high Killip class was associated with higher risk for mortality. In the GRACE study also, increasing Killip class associated with worse prognosis, which is compatible with Philippe Gabriel Steg et al (18)

S.creatinine level at admission is an independent predictor of in-hospital mortality in patients with ACS (19), but there was no significant correlation with mortality in this study, which is compatible with sabah et al (14), and incompatible with Rangamanikandan M, Shivcharan Jelia, Meena S. R et al(16).

Like in the GRACE registry, this study also showed a lower SBP at admission is significantly associated with more events, which is compatible with Rangamanikandan M, Shivcharan Jelia, Meena S. R et al (16) and sabah et al(14).

Important to a prognostic score are accuracy and ease of use. The GRACE score fulfills these criteria and also includes newer prognostic variables

## **Conclusion**

- 1- GRACE score is an important prognostic tool that can be easily applied to each patient admitted with ACS.
- 2- GRS not only used for predicted the risk of in-hospital death among ACS patients, but can be used a guide for intervention therapy.
- 3- According to the 8 parameters of GRACE risk score, age above 60yrs, heart rate >110bpm, SBP <100 mmhg, killip class III-IV, cardiac markers elevated, and ST segment deviation were associated with high risk of mortality.

## **Recommendation**

- 1- GRACE RS should be studies in large numbers and in multi-centers.
- 2- GRCE RS should used routinely in every CCU to classified and identify the high-risk patients to reinforce urgent intervention among high risk to decrease mortality.

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