VALUE OF THE CLINICAL SYNTAX SCORE FOR PREDICTION OF 1-YEAR MORTALITY IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION UNDERGOING PERCUTANEOUS CORONARY INTERVENTION

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SUMMARY

Objectives: To study the prediction value of clinical SYNTAX score in patients with acute myocardial infarction undergoing percutaneous coronary intervention in 30 days and one year. Subjects and methods: 579 patients with acute myocardial infarction, of whom 296 patients were followed from 30 days to 1-year. Mortality and major cardiovascular events after 30-day and 1-year and clinical SYNTAX score were analysed. Results: The patients were divided into three groups according to the clinical SYNTAX score: clinical SYNTAX score 1 (clinical SYNTAX score 1) < 22.95 (115 patients), mean clinical SYNTAX score (clinical SYNTAX score 2) from 22.95 to less than 35.95 (74 patients), high clinical SYNTAX score (clinical SYNTAX score 3) ≥ 35.95 (107 patients). The highest survival rates in the low-scoring group after 30 days and after 1-year was 95.7% and 93.0% compared with 93.2% and 85.1% in the clinical SYNTAX score mid group compared to 79.4% and 73.8% in the clinical SYNTAX score high group, the difference was significant with p < 0.001. The incidence of major cardiovascular events was low in the low-scoring group after 30 days and 1-year (94.6% and 88.7%) compared with the clinical SYNTAX score mid group (93.0% and 91.9%) and the clinical SYNTAX score high group (87.9% and 86.0%), with p (log-rank) = 0.164 and p (log-rank) = 0.445. Conclusion: Clinical SYNTAX score was useful in predicting mortality in patients with acute myocardial infarction undergoing percutaneous coronary intervention in short and long-term.

* Keywords: Acute myocardial infarction; Clinical SYNTAX score; Percutaneous coronary intervention.

INTRODUCTION

Cardiovascular disease is the most common cause of death in the world. The global burden study 2013 (GBD) estimated that cardiovascular disease caused 17.3 million deaths, accounting for 31.5% of total deaths and 45% of total deaths due to non-communicable diseases and resulted in premature death to more than 1.4 million people before 75 years old in Europe [1]. The new definition of the World Health Organization (WHO), myocardial infarction is the increase and/or decrease of myocardial biomarkers upper 99% of its limit and at least one of the characteristics; typical chest pain, electrocardiographic changes, regional movement disorders detected by imaging diagnostic measures or evidence of thrombosis in coronary artery [1]. It is the leading cause of death and also a major cause of the burden of disease in developing countries.

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Saving lives of acute myocardial patients is an immediate task of clinicians but is not enough, we need to predict the risk of cardiovascular for patients after the intervention. There are many parameters and transcripts to help clinicians predict patients with myocardial infarction under intervention such as: Leamen score, Zwolle, MAYO, PAMI, CADILLAC, GRACE, ACEF, Gensini. However, these scales have many limitations, so far they have not been widely applied in clinical practice for these patients.

The SYNTAX score (CSS) was born in 2005, inheriting and developing previous scores. CSS incorporate additional clinical factors that can predict major cardiovascular events under percutaneous coronary intervention during short and long term periods [3]. Therefore, we conducted this study aiming: *To study the prognostic value after 1 year of CSS in patients with acute myocardial infarction undergoing percutaneous coronary intervention.*

SUBJECTS AND METHODS

1. Subjects.

579 patients with acute myocardial infarction received percutaneous intervention at Vietnam National Heart Center and 103 Military Hospital, from May 2015 to February 2018. 296 patients were followed after intervention from 30 days to 12 months, there were 7 critically ill patients after the intervention and death.

* Selection criteria:

All patients with acute myocardial infarction received percutaneous coronary intervention at Vietnam National Heart Center and 103 Military Hospital from January 2015 to February 2018.

* Diagnostic criteria for myocardial infarction according to the 3rd consensus definition of WHO/ESC/AHA/ACC in 2012:

* Exclusion criteria: Contraindications to use of antiplatelet agents such as aspirine, clopidogrel, contrast, hepatic, renal failure... and patients did not agree to participate.

2. Methods.

* Study content:

- Study design: Follow-up with comparative analysis.

- SYNTAX score by software SYNTAX score calculator 2.11.

- Calculate CSS:

The formula: CSS = SS x (AGE/EF) + 1 (for each drop of creatinine 10 mL/minute with creatinine clearance < 60 mL/minute/1.73 m^2).

- Major cardiovascular events: All-cause mortality, target vessel myocardial infarction, stroke, target vessel revascularization.

* Data:

Information collected from the research record will be processed according to the medical statistical algorithms of Epi.Data and SPSS 21.0 software.

For comparison, we used the algorithm "t-test", test χ^2, odds ratio (odds ratio), logistic regression algorithm, log-rank test...

Results are considered statistically significant with $p < 0.05$.

RESULTS

Calculating the cut-off point of the CSS, we divided the patients into three groups of high, medium and low score as follows:

CSS is low (CSS1) < 22.95 (115 patients), middle CSS (CSS2): 22.95 - < 35.95 (74 patients), high CSS score (CSS3) ≥ 35.95 (107 patients).

Table 1: General characteristics of patients study.

Characteristics	$\overline{X} \pm$ SD or n (%)
Male	450 (77.7%)
Average age	65.55 ± 10.89
History of hypertension	301 (52%)
History of diabetes	77 (13.3%)
Heart rate	80.15 ± 17.59
Systolic blood pressure (mmHg)	123.68 ± 23.32
Diastolic blood pressure (mmHg)	75.68 ± 14.26
Killip ≥ 2	86 (14.9%)
Creatinine	95.62 ± 27.64
EF < 40%	96 (16.6%)
Door-to-ballon time (minutes)	816.22 ± 1501.12
DES (drug-coated stent)	555 (95.9%)
TIMI 3 before intervention	93 (16.1%)
TIMI 3 after intervention	566 (97.8%)
One vessel disease	202 (34.9%)
Two vessel disease	217(37.5%)
Three vessel disease	160 (27.6%)
≥ 1 bifurcation	181 (31.3%)
≥ 1 trifurcation	6 (1.0%)
≥ 1 occlusion	338 (67.0%)
≥ 1 tortuous lesion	32 (5.5%)
≥ 1 lesion ≥ 20 mm	258 (44.6%)
≥ 1 calcified lesion	65 (11.2%)
≥ 1 lesion with thrombus	406 (70.1%)
≥ 1 ostial lesion	53 (9.2%)

The male patient was 3 times higher than females. Patients with a history of hypertension made up the highest rate (52.0%). One vessel disease accounted for 34.9%, less common than multi vessel disease. Patients received drug-coated stent occupied 95.9% and the rate of coronary artery flow after intervention improved very well with TIMI 3 at 97.8%.
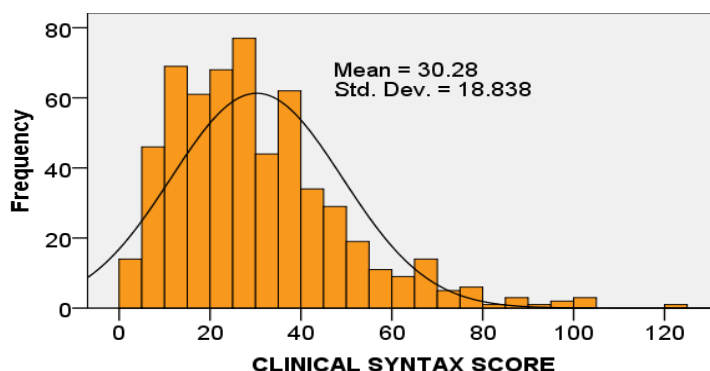
Figure1: Distribution of CSS.

The number of patients with CSS was around 25. The lowest was the group of patients with scores between 75 - 100 points. The average CSS was 30.28 ± 18.84.

Table 2: Relationship between CSS and death.

Death	CSS1	CSS2	CSS3	p
	n (%)	n (%)	n (%)	
After 30 days	5 (4.3%)	5 (6.8%)	22 (20.6%)	< 0.001
After 180 days	5 (4.3%)	8 (10.8%)	24 (22.4%)	< 0.001
12 months	8 (7.0%)	11 (14.9%)	28 (26.2%)	< 0.001

30 days after intervention, mortarity in the CSS3 group was the highest (20.6%) compared to groups CSS2 and CSS1 (6.8% and 4.3%), respectively, $p < 0.001$, which was statistically significant. The results were similar after intervention for 180 days and 12 months.

Table 3: Relevant linear regression analysis between CSS groups and death.

Time	HR[1,2] (95%CI)	p	HR[1,3] (95%CI)	p	HR[3,2] (95%CI)	p
30 days	1.57 (0.45 - 5.41)	0.478	5.12 (1.94 - 13.53)	0.001	0.31 (0.12 - 0.81)	0.017
180 days	2.51 (0.82 - 7.69)	0.106	5.69 (2.17 - 14.94)	< 0.001	0.44 (0.198 - 0.98)	0.045
12 months	2.19 (0.88 - 5.44)	0.092	4.23 (1.94 - 9.36)	< 0.001	0.51 (0.26 - 1.03)	0.061

After 30 days, mortality in the CSS3 group was 5.12 times higher than CSS1 group, the difference was significant ($p < 0.05$) and (HR = 5.12 and 95%CI from 1.94 to 13.53, p = 0.001). After 12 months, the mortality rate of CSS3 group was 4.23 times higher than CSS1 group, the difference was significant ($p < 0.05$) and (HR = 4.23 and 95%CI from 1.94 to 9.36 with p < 0.001).
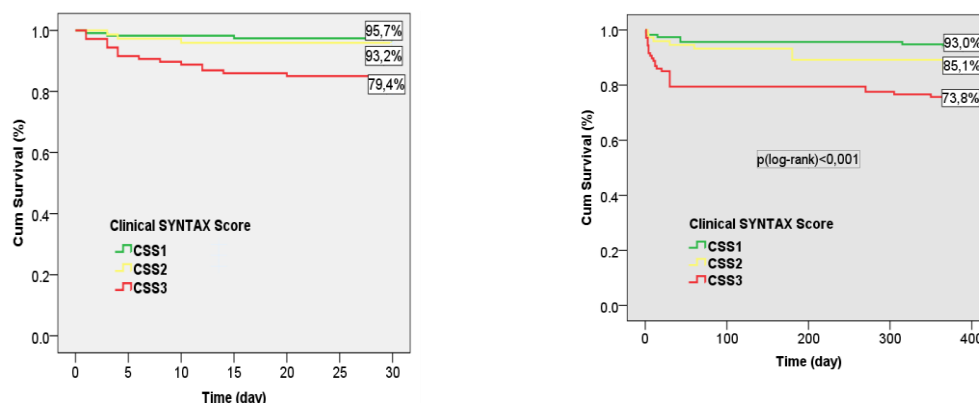
Figure 2: Kaplan-Meier survival after 30 days and 1 year.

High CSS (CSS3) had the lowest survival rate of 79.4%, middle CSS group (CSS2) and low CSS1 had the corresponding rate of 93.2% and 95.7%, respectively with p (Log-rank) < 0.001), with statistical significance. Similarly, the survival rate after 12 months of the three groups was also significantly different with p (Log-rank) < 0.001.

Table 4: Relationship between CSS and events.

Major cardiovascular events	CSS1	CSS2	CSS3	p
	n (%)	n (%)	n (%)	
After 30 days	8 (7.0%)	4 (5.4%)	13 (12.1%)	0.211
After 180 days	11 (9.6%)	6 (8.1%)	13 (12.1%)	0.653
12 months	13 (11.3%)	6 (8.1%)	15 (14.0%)	0.470

It can be seen that after 30 days, 180 days, 12 months of intervention, the CSS3 group had the highest rate of occurrence of mortality and major cardiovascular events being 12.1%; 12.1% and 14.0% compared to CSS2 group with the rates of 5.4%, 8.1% and 8.1%, respectively and 7.0%, 9.6%, 11.3%, respectively in CSS1 group. However, this difference was not significant with p > 0.05.
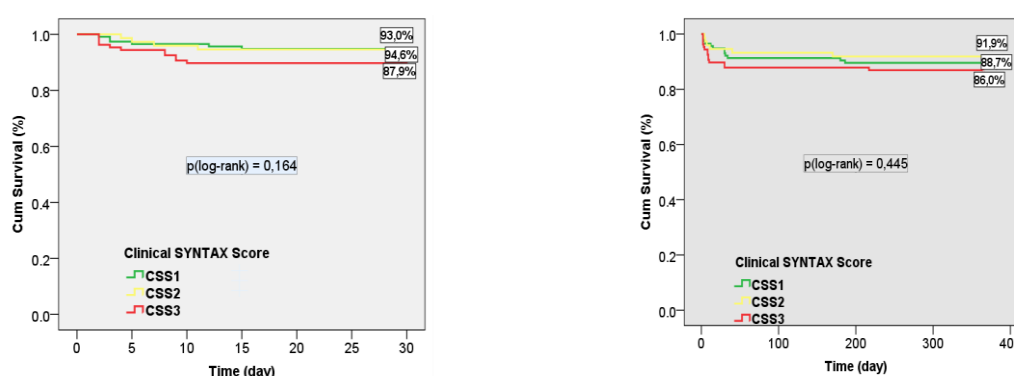

Figure 3: Kaplan-Meier without major cardiovascular events after 30 days and 1 year.

Kaplan-Meier of CSS3 group (red line) had no lowest event rate of 87.9% compared with the remaining two clinical SYNTAX groups p (Log-rank) > 0.05. In other words, the major cardiovascular events rate of the CSS3 group was the highest. Similar to the results after 12 months, we also found that the higher the CSS score, the more likely the occurrence rate of events. However, the difference was not significant p > 0.05.

DISCUSSION

1. Relationship between CSS and death.

From the results, we found that: there were 32 patients who died after 30 days, the highest death rate in the CSS3 group was 22/107 patients (20.6%), compared to two groups of middle score CSS2 (5/74 patients = 6.8%) and low score CSS1 (5/115 patients = 4.3%) with p < 0.001 statistically significant. The mortality in the CSS3 group was 5.12 times higher than CSS1 group, the difference was significant (p < 0.05) and (HR = 5.12 and 95%CI from 1.94 to 13.53 with p = 0.001). Similarly, after 12 months, the mortality rate of CSS3 group was 4.23 times higher than that of CSS1 group, the difference was significant (p < 0.05) and (HR = 4.23 and 95%CI from 1.94 to 9.36, p < 0.001). The Kaplan-Meier, we found that the high CSS3 group had the lowest survival of 79.4% (red line) compared to the middle CSS2 (93.2%) (yellow line) and low score group CSS1 (95.7%) (blue line), the difference was statistically significant with p (Log-rank) < 0.001. These results were similar after 12 months (*table 2, table 3 and figure 2*).

CSS is an independent prognostic factor for the risk of death in patients with acute myocardial infarction under coronary artery intervention 30 days and 12 months.

Cetinkal G et al conducted a study on 433 patients who were diagnosed with STEMI and underwent p-percutaneous coronary intervention. CSS was calculated by multiplying the anatomically derived SYNTAX score (Sx) by the modified age, creatinine, and ejection fraction score. Patients were divided into tertiles according to the CSS: CSS (low) ≤ 14 (141 patients), 14 < CSS (mid) ≤ 26 (144 patients) and CSS (high) > 26 (148 patients). The primary endpoints were defined as all-cause mortality, myocardial infarction, and cerebrovascular events over 15 months' follow-up. Primary endpoints achieved in 9.2% of patients with CSS ≤ 14, 12.5% of them had 14 < CSS ≤ 26 and 28.4% of them had CSS > 26 (p < 0.001). Kaplan-Meier analysis showed that the CSS > 26 group had a significantly higher incidence of primary endpoints [p (Log-rank) < 0,001]. CSS > 26 was identified as an independent predictor for all-cause mortality, myocardial infarction, and cerebrovascular events (HR = 3.58, 95%CI from 1.68 to 7.60, p = 0.001). Receiver operating characteristic analysis found areas under the curve of 0.66, 0.59, and 0.64 for CSS, Sx score and age, creatinine and ejection fraction score (p < 0.001, p = 0.01, p < 0.001, respectively) [4].

From January 2013 to December 2013, He C et al carried out a study on 6,099 consecutive patients with ACS admitted to FuWai Hospital and underwent percutaneous coronary intervention.

Patients were divided into low CSS group (CSS ≤ 6.5; 2,012 patients), mid-CSS group (6.5 < CSS < 13.8; 2,056 patients) and high CSS group (CSS ≥ 13.8; 2.031 patients). At 2-year follow-up, rates of cardiac death and major adverse cardiac events were significantly higher in high CSS group. Compared with baseline SS, CSS demonstrated a significant improvement in performance for 2-year cardiac death (receiver-operating characteristic curve C-statistics: 0.74 vs. 0.62, p < 0.001) but not for and major cardiovascular events (receiver-operating characteristic curve C-statistics: 0.60 vs. 0.59, p = 0.29) [5].

2. Relationship between CSS and and major cardiovascular events.

After 30 days, the rate of major cardiovascular events in the high score group CSS3 was the highest (12.1%) compared to the average group of CSS2 scores (5.4%) and the low score group CSS1 (7.0%), with p = 0.211. When analyzing the Kaplan-Meier, we found that the high score group CSS3 without events was the lowest (87.9%) (red line) compared to the average group of CSS2 score of 94.6% (yellow line) and low score CSS1 (93.0%) (blue line), the difference was not statistically significant with p (Log-rank) = 0.164. At 12 months, we found that the occurrence rate of high-point group CSS3 was the highest (14.0%) compared to the group of CSS2 (8.1%) and the low score group CSS1 (11.3%). However, the difference was not statistically significant (with p > 0.05). Kaplan-Meier after 1-year, we found that the high score group CSS3 without events was the lowest (86.0%) (red line)

compared to the average group of CSS2 (91.9%) (yellow line) and the low score group CSS1 (88.7%) (blue line), the difference was not statistically significant with p (Log-rank) = 0.445 (*table 4 and figure 3*).

Pyxaras SA, ACEF and CSS were calculated in 221 consecutive patients with stable angina undergoing rota-stenting. Mean age of the patients was 74 ± 10 years, left ventricular ejection fraction was 61 ± 18% and final burr size 1.78 ± 0.24 mm, of which 2.6 ± 0.9 burrs used for each patient. Primary end-point was major cardiovascular events at one-year defined as the composite of cardiac death, myocardial infarction, and target vessel revascularization. Post-hoc analysis was performed by stratifying the clinical outcome according to ACEF and CSS tertiles. At 1 year, there was a significantly higher major cardiovascular events rate in the high tertile of ACEF (24% for ACEF high vs. 13% for ACEF mid vs. 9% for ACEF low; p = 0.017) and CSS (25% for CSS high vs. 12% for CSS mid vs. 8% for CSS low; p = 0.008). The predictive accuracy for both ACEF and CSS was moderate (c-statistics, 0.629 and 0.638, respectively). Both ACEF and CSS can predict with moderate accuracy and major cardiovascular events at 1-year in patients with heavily calcified coronary stenosis undergoing rotational atherectomy with stent implantation [6].

CONCLUSION

Clinical SYNTAX score is valuable in prognosis of mortality for patients with acute myocardial infarction after coronary intervention during 30 days and 12 months.

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