Original Article

Impact of Residual SYNTAX Score and Its Derived Indexes on Clinical Outcomes after Percutaneous Coronary Intervention: Data from a Large Single Center

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Abstract

Background: Residual SYNTAX score (rSS) and its derived indexes including SYNTAX revascularization index (SRI) and clinical rSS had been developed to quantify and describe the extent of incomplete revascularization. This study was conducted to explore the utility of the three scores among real-world patients after percutaneous coronary intervention (PCI).
Methods: From January 2013 to December 2013, patients underwent PCI treatment at Fuwai Hospital were included. The primary endpoints were all-cause death and major adverse cardiovascular and cerebrovascular events. The secondary endpoints were myocardial infarction, revascularization, stroke, and stent thrombosis. Kaplan-Meier methodology was used to determine the outcomes. Cox multivariable regression was to test the associations between scores and all-cause mortality.
Results: A total of 10,344 patients were finally analyzed in this study. Kaplan-Meier survival analysis indicated that greater residual coronary lesions quantified by rSS and its derived indexes were associated with increased risk of adverse cardiovascular events. However, after multivariate analysis, only clinical rSS was an independent predictor of 2-year all-cause death (hazard ratio: 1.02, 95% confidence interval: 1.01–1.03, $P < 0.01$). By receiver operating characteristic (ROC) curve analysis, clinical rSS had superior predictability of 2-year all-cause death than rSS and SRI (area under ROC curve [AUC]: 0.59 vs. 0.56 vs. 0.56, all $P < 0.01$), whereas rSS was superior in predicting repeat revascularization than clinical rSS and SRI (AUC: 0.62 vs. 0.61 vs. 0.61; all $P < 0.01$). When comparing the predictive capability of rSS ≥8 with SRI <70%, their predictabilities were not significantly different.
Conclusions: This study indicates that all three indexes (rSS, clinical rSS, and SRI) are able to risk-stratify patients and predict 2-year outcomes after PCI. However, their prognostic capabilities are different.

Key words: Clinical Outcome; Percutaneous Coronary Intervention; Risk Assessment; Risk Stratification

Introduction

For patients with multivessel coronary disease, percutaneous coronary intervention (PCI) frequently involves incomplete revascularization (IR) because of coronary anatomy complexity or coexisting serious clinical conditions.[1-3] The prognostic impact of IR after PCI had been inconsistent among studies,[4-7] and one potential explanation was due to the lack of consent definition of IR.[8]

Recently, residual SYNTAX score (rSS) and its derived other two indexes including SYNTAX revascularization index (SRI) and clinical rSS had been developed as the tool to better quantify and describe the extent of IR.[9-16] Among them, rSS and SRI were purely anatomic indexes: rSS represented untreated baseline lesions in coronary artery,[9-13] and SRI represented the proportion

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of treated baseline coronary artery lesion.[14,15] Whereas, clinical rSS was an index combining anatomic (rSS) with clinical variables (modified age, creatinine, and ejection fraction [ACEF] score).[16]

Although the indexes aforementioned had been proven to have prognostic capacity after PCI,[9-16] to date, few studies have explored the utility of all these indexes among the unselective real-world patients undergoing contemporary PCI treatment. Therefore, the present study was conducted to assess and compare the prognostic capacity of these indexes in a large cohort population of patients undergoing PCI in daily practice.

Methods

Ethical approval

The study was conducted in accordance with the *Declaration of Helsinki* and was approved by the Ethics Committee of Fuwai Hospital (Approval No. 2013-449), and each patient provided informed written consent written informed consent before PCI.

Study population

This study was a cohort study and 10,723 consecutive patients who underwent PCI treatment at Fuwai Hospital, National Center for Cardiovascular Diseases, from January to December 2013, were included. After excluding patients with a history of previous coronary artery bypass grafting, 10,344 patients were finally analyzed in this study. The SYNTAX score (SS) and the rSS from all coronary angiograms, using standard quantitative coronary analysis methodology, were assessed by an independent angiographic core laboratory blinded to clinical outcomes.[9,17] The SRI was calculated with the following formula: SRI = (1-rSS/baseline SS) × 100.[14] The clinical rSS was calculated by multiplying the rSS with the "modified ACEF" score.[18]

Procedures and medications

The PCI strategies and stent types were left to treating physician's discretion. If not taking long-term aspirin and P2Y12 inhibitors, selective PCI patients received oral 300 mg aspirin and clopidogrel (loading dose 300 mg) or ticagrelor (loading dose 180 mg) at least 24 h before the procedure. Patients with acute coronary syndrome scheduled for primary PCI received the same dose aspirin and ticagrelor or clopidogrel (loading dose 300 mg or 600 mg) as soon as possible. During the procedure, unfractionated heparin (100 U/kg) was administered to all patients, and use of glycoprotein IIb/IIIa inhibitors was depended on operator's judgment. After the procedure, aspirin was prescribed at a dose of 100 mg daily indefinitely; clopidogrel 75 mg daily or ticagrelor 90 mg twice daily was advised for at least 1 year after PCI.

Patient follow-up

All patients were evaluated by clinic visit or by phone at 1, 3, 6, and 12 months and annually thereafter. Patients were advised to return for coronary angiography if clinically indicated by symptoms or documentation of myocardial ischemia. Two-year follow-up was completed for 10,287 (99.4%) patients.

Endpoints and definitions

Myocardial infarction (MI) was defined by the third universal definition of MI.[19] Revascularization was defined as repeated revascularization for ischemic symptoms and events driven by PCI or surgery of any vessel. Stent thrombosis (ST) was defined on the basis of the Academic Research Consortium definitions according to the level of certainty as definite, probable, and possible.[20] Major adverse cardiovascular and cerebrovascular events (MACCEs) were defined as the occurrence of death, MI, revascularization, ST, and stroke during follow-up period. Procedural success was defined as residual stenosis <50% and without in-hospital MACCE. All endpoints were adjudicated centrally by two independent cardiologists, and disagreement was resolved by consensus.

Statistical analysis

Continuous variables are shown as mean ± standard deviation (SD) or median (Q1, Q3), while categorical variables are reported as counts or percentage. For the baseline characteristics, generalized linear models were used to compare continuous variables across rSS groups with rSS class as a covariable, while the Cochran-Armitage test for trends was used for categorical data. Clinical outcomes were determined using Kaplan-Meier methodology. To test for possible associations between the SYNTAX indexes and the rates of long-term mortality, stepwise Cox multivariable regression analysis was used, with variable entry/stay criteria of 0.1/0.1. In addition, variables historically known to be associated with long-term mortality were included in the model. The proportional hazard assumption was verified for each endpoint using the supremum test. Receiver operating characteristic curves were used to compare the prognostic ability of the various risk scores to predict the rates of ischemic adverse events. Statistical analyses were performed using SPSS version 23 (IBM Corporation, Armonk, New York, USA). A $P < 0.05$ was considered statistically significant.

Results

Patients and baseline characteristics

The mean baseline SS was 13.6 ± 9.1 (range: 1.0–58.0), and the complete revascularization (CR) (rSS = 0, clinical rSS = 0, and SRI = 100) was achieved in 52.0% (5375/10,344) of patients. Patients who underwent IR were further categorized into three groups according to rSS, clinical rSS, and SRI tertiles [Table 1 and Supplementary Tables 1, 2]. Patients in higher rSS levels had higher clinical risks including older age, decreased renal function, lower LVEF, more comorbidities, and higher baseline SS. Similarly, patients in higher clinical rSS and lower SRI levels had similar baseline characteristics as in higher rSS levels.

Table 1: Baseline characteristics of all patients after PCI according to rSS						
Characteristics	rSS = 0 (*n* = 5375)	0< rSS ≤S4 (*n* = 1995)	4< rSS ≤8 (*n* = 1406)	rSS >8 (*n* = 1568)	Statistical values	*P* (for trend)
Age (years)	57 ± 10	58 ± 10	59 ± 10	60 ± 10	39.21*	<0.01
Male	4140 (77.0)	1523 (76.3)	1095 (77.9)	1210 (77.2)	1.13†	0.77
BMI (kg/m^2)	25.9 ± 3.2	26.0 ± 3.2	26.0 ± 3.1	26.0 ± 3.1	0.78*	0.51
eGFR <90 ml/min	1871 (34.8)	767 (38.4)	599 (42.6)	708 (45.2)	70.19†	<0.01
LVEF <40 ml/min	17 (0.3)	6 (0.3)	7 (0.5)	9 (0.6)	6.02†	0.11
Clinical history						
Diabetes mellitus	1398 (26.0)	709 (35.5)	447 (31.8)	554 (35.3)	93.18†	<0.01
Hypertension	3321 (61.8)	1350 (67.7)	909 (64.7)	1061 (67.7)	32.39†	<0.01
Hyperlipidemia	3545 (66.0)	1380 (69.2)	966 (68.7)	1051 (67.0)	8.73†	0.03
Previous stroke	491 (9.1)	242 (12.1)	162 (11.5)	214 (13.6)	33.24†	<0.01
Peripheral vascular disease	121 (2.3)	53 (2.7)	39 (2.8)	57 (3.6)	9.37†	0.02
COPD	114 (2.1)	44 (2.2)	39 (2.8)	39 (2.5)	2.50†	0.48
Family history of CAD	1298 (24.2)	510 (25.6)	330 (23.5)	414 (26.4)	5.26†	0.15
Current smoker	3057 (56.9)	1143 (57.3)	797 (56.7)	891 (56.8)	0.16†	0.98
Previous MI	884 (16.4)	373 (18.7)	298 (21.2)	366 (23.3)	46.06†	<0.01
Previous PCI	1203 (22.4)	503 (25.2)	386 (27.5)	424 (27.0)	25.64†	<0.01
Clinical presentation						
ACS	3334 (62.0)	1180 (59.1)	832 (59.2)	891 (56.8)	15.27†	<0.01
Stable angina	1620 (30.1)	647 (32.4)	463 (32.9)	529 (33.7)		
Silent ischemia	421 (7.8)	168 (8.4)	111 (7.9)	148 (9.4)		
Angiographic and procedural characteristics						
CAD extension						
LM disease	131 (2.4)	48 (2.4)	41 (2.9)	36 (2.3)	1.41†	0.70
3-vessel disease	1228 (22.8)	1005 (50.4)	851 (60.5)	1132 (72.2)	1659.72†	<0.01
Type of stents						
BMS	27 (0.5)	12 (0.5)	5 (0.4)	13 (0.8)	3.52†	0.32
DES	5198 (96.7)	1915 (96.0)	1320 (93.9)	1338 (85.2)	311.35†	<0.01
PTCA	104 (1.9)	39 (2.0)	35 (2.5)	52 (3.3)	11.79†	0.01
IVUS use	302 (5.6)	110 (5.5)	80 (5.7)	88 (5.6)	0.05†	1.00
IABP use	57 (1.1)	25 (1.3)	17 (1.2)	40 (2.6)	20.81†	<0.01
Procedural success	5329 (99.1)	1966 (98.5)	1360 (96.7)	1403 (89.5)	437.96†	<0.01
Baseline SYNTAX score	9.0 ± 6.5	11.6 ± 6.7	14.3 ± 6.1	21.3 ± 7.2	1574.50*	<0.01

The data are shown as mean ± SD or *n* (%). **F* value; †Chi-square value. BMI: Body mass index; eGFR: Estimated glomerular filtration rate; LVEF: Left ventricular ejection fraction; COPD: Chronic obstructive pulmonary disease; CAD: Coronary artery disease; MI: Myocardial infarction; PCI: Percutaneous coronary intervention; ACS: Acute coronary syndrome; BMS: Bare metal stent; DES: Drug-eluting stent; PTCA: Percutaneous transluminal coronary angioplasty; IVUS: Intravenous ultrasound; IABP: Intra-aortic balloon pump; rSS: Residual SYNTAX score; SD: Standard deviation; LM: Left main.

Clinical outcomes

As shown in Figure 1, among different rSS groups, there were significant differences of the rates of all-cause death (1.0% vs. 1.1% vs. 1.4% vs. 1.8%, $P < 0.01$), revascularization (5.8% vs. 9.7% vs. 10.0% vs. 15.4%, $P < 0.01$), and MACCE (8.7% vs. 13.4% vs. 13.9% vs. 20.0%, $P < 0.01$). Moreover, there were also significant differences of the rates of all-cause death (1.0% vs. 0.9% vs. 0.7% vs. 2.5%, $P < 0.01$), revascularization (5.8% vs. 9.7% vs. 10.5% vs. 14.6%, $P < 0.01$), and MACCE (8.7% vs. 13.0% vs. 13.8% vs. 20.0%, $P < 0.01$) among different clinical rSS groups [Figure 1]. Patients in higher rSS or clinical rSS groups had higher incidence of adverse clinical events. Although the incidence of all-cause death was not different among patients in different SRI groups (1.0% vs. 1.1% vs. 2.6% vs. 2.5%, $P = 0.13$), rates of revascularization (5.8% vs. 10.7% vs. 9.7% vs. 14.4%, $P < 0.01$) and MACCE (8.7% vs. 14.3% vs. 13.7% vs. 18.8%, $P < 0.01$) were still significantly higher in patients in lower SRI groups [Figure 1]. After multivariate analysis, only clinical rSS was an independent predictor of 2-year mortality (hazard ratio: 1.02, 95% confidence interval: 1.01–1.03; $P < 0.01$); however, all these three indexes were independent predictors of MI, revascularization, and MACCE [Figure 2].

Predictive capability of residual SYNTAX score, clinical residual SYNTAX score, and SYNTAX revascularization index

By receiver operating characteristic (ROC) curve analysis, all these IR indexes were significantly associated with adverse cardiac events [Table 2]. When comparing these IR indexes with each other, the clinical rSS had superior predictability of 2-year all-cause death than rSS (area under ROC curve [AUC]: 0.59 vs. 0.56, $P < 0.01$) and SRI (AUC: 0.59 vs. 0.56, $P < 0.01$), and the rSS was

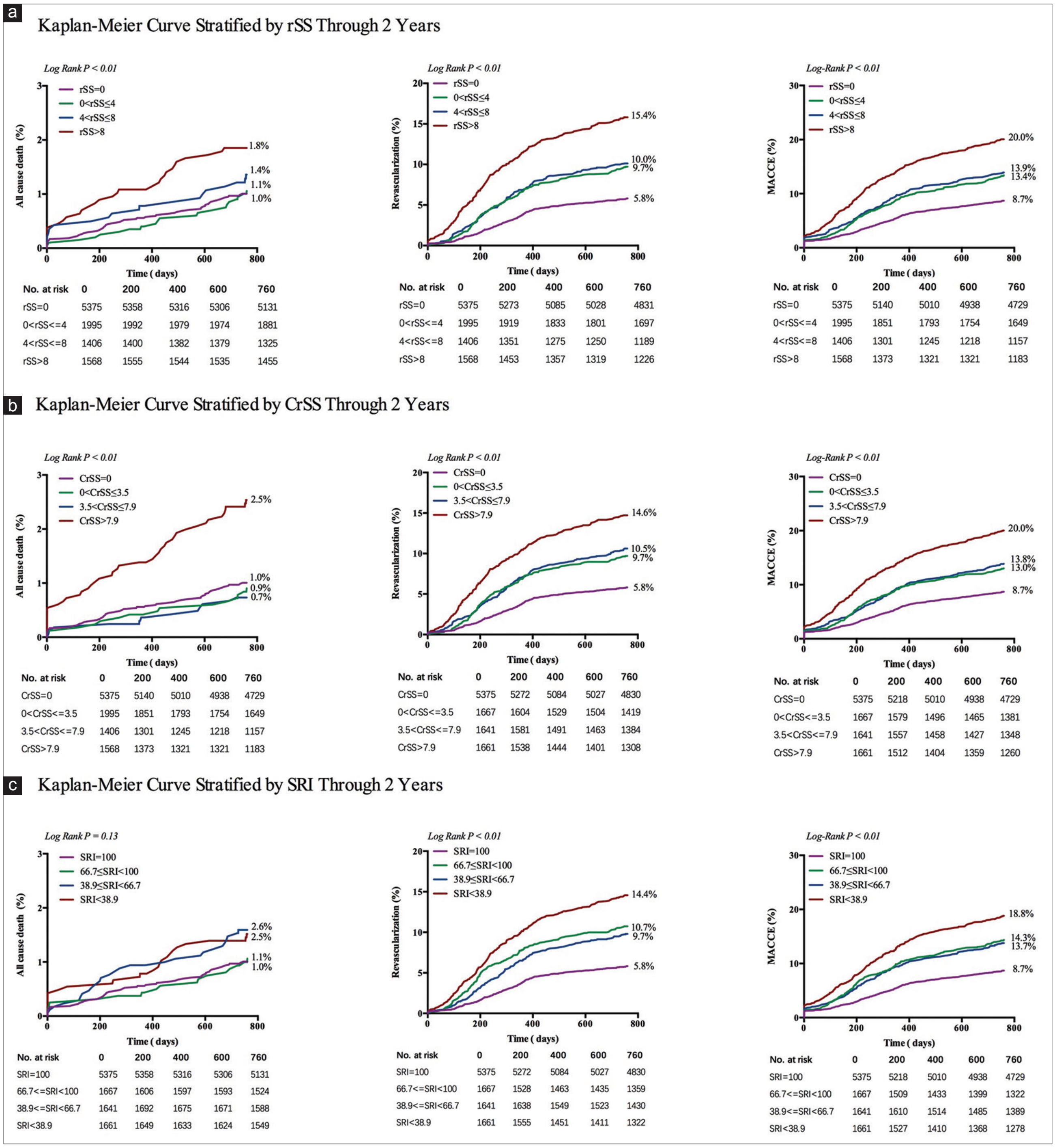

Figure 1: Kaplan-Meier curve showing event rates stratified by rSS (a), CrSS (b), and SRI (c) scores through 2 years. rSS: Residual SYNTAX score; CrSS: Clinical residual SYNTAX score; SRI: SYNTAX revascularization index; MACCE: Major adverse cardiovascular and cerebrovascular events.

superior in predicting repeat revascularization than clinical rSS (AUC: 0.62 vs. 0.61, $P < 0.01$) and SRI (AUC: 0.62 vs. 0.61, $P < 0.01$). Of note, when only comparing the predictive capability of rSS ≥8 with SRI <70%, their predictabilities of 2-year all-cause death (AUC: 0.54, 95% confidence interval [*CI*]: 0.53–0.55 vs. AUC: 0.57, 95% *CI*: 0.56–0.58, $P = 0.21$), repeat revascularization (AUC: 0.57, 95% *CI*: 0.56–0.58 vs. AUC: 0.57, 95% *CI*: 0.56–0.58, $P = 0.47$), and MACCE (AUC: 0.56, 95% *CI*: 0.55–0.57 vs. AUC: 0.57, 95% *CI*: 0.59–0.58, $P = 0.09$) were not significant different.

Discussion

In this study, which included a large cohort of real-world patients undergoing contemporary PCI treatment, we assessed the degree of IR by rSS and its derived indexes (clinical rSS and SRI) on clinical outcomes. The major findings of this study were as follows: (1) all these IR indexes were able to risk-stratify patients and predict 2-year composite adverse cardiovascular events after PCI; (2) only clinical rSS was an independent predictor of 2-year mortality; (3) clinical

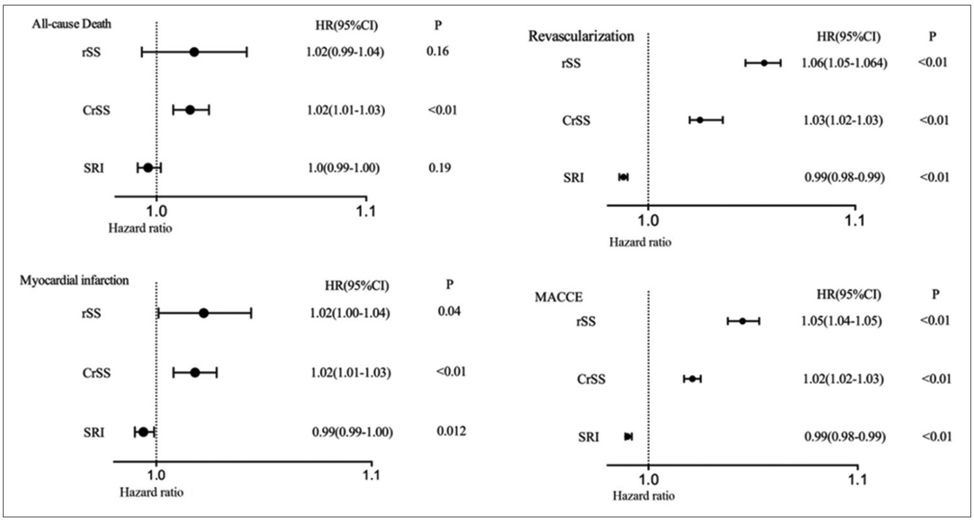

Figure 2: Predictability of 2-year mortality and adverse events of IR scores. The following variables were included in each model: (1) for all-cause death and myocardial death: male, age, diabetes, hypertension, hyperlipoidemia, current smoking, renal dysfunction, left ventricular ejection fractions <40%, acute cardiovascular syndrome, and drug-eluted stent; (2) for myocardial infarction and MACCE: male, age, diabetes, hypertension, hyperlipoidemia, current smoking, renal dysfunction, previous myocardial infarction, previous percutaneous cardiovascular intervention, left ventricular ejection fractions <40%, acute cardiovascular syndrome, and drug-eluted stent; (3) for unplanned revascularization: male, age, diabetes, hypertension, hyperlipoidemia, current smoking, renal dysfunction, previous percutaneous cardiovascular intervention, left ventricular ejection fractions <40%, acute cardiovascular syndrome, and drug-eluted stent. rSS: Residual SYNTAX score; CrSS: Clinical residual SYNTAX score; SRI: SYNTAX revascularization index; *HR*: Hazard ratio; *CI*: Confidence interval; MACCE: Major adverse cardiovascular and cerebrovascular event; IR: Incomplete revascularization.

rSS had superior predictability of 2-year all-cause death than other two anatomic rSS and SRI, whereas rSS was superior in predicting repeat revascularization than clinical rSS and SRI; and (4) IR level of rSS ≥ 8 and SRI <70% had same predictability of 2-year all-cause death, repeat revascularization, and MACCE.

CR in this unselected real-world PCI patients was achieved in 51.9%, which was higher than prior studies.[9,16,21] We found that patients with greater residual coronary lesions after PCI, as quantified by the rSS and its derived indexes, had higher clinical risks such as older age, decreased renal function, lower LVEF, more comorbidities, and higher baseline SS. These associations reflected a clinical phenomenon that patients at higher risks tend to be received IR, just as prior studies indicated.[9,16]

Previous studies demonstrated that rSS had prognostic capacity in patients undergoing PCI treatment,[9-14] and a rSS ≥ 8 was identified as a level of IR strongly associated with increased mortality and adverse ischemic events.[9,10] In addition, two novel indexes derived from rSS were developed to assess the degree of revascularization after PCI lately. SRI, representing the proportion of treated baseline coronary artery lesions, had been shown to be an independent predictor of mortality after PCI;[14,15] a SRI <70% was identified as a "reasonable" goal to be achieved for patients with complex coronary artery disease who underwent PCI treatment.[15] Clinical rSS, which combined clinical variables (modified ACEF score) with the rSS, had been demonstrated to have superior predictability of 1-year all-cause death after PCI compared with rSS.[16]

This study assessed the prognostic capacity of all these IR indexes in one same large cohort, which added evidence of using rSS and its derived scores to evaluate and guide the revascularization of PCI treatment. The results demonstrated that all these IR indexes were able to risk-stratify patients and predict 2-year composite adverse cardiovascular events after PCI. Clinicians could select either of these indexes as a tool to quantify and describe the extent of IR by PCI revascularization and to predict patients' prognosis. In addition, we also found in the present study that only clinical rSS was an independent predictor of 2-year mortality after multivariate analysis. It was because that one of the outstanding limitations of rSS and SRI were lesion-based scoring system only including angiographic variables. Prior reports have demonstrated that combining the modified ACEF score with the SS could improve the ability of SS values to predict clinical outcomes.[18,22] And just as a recently published report indicated,[16] the clinical rSS, which combined the modified ACEF score with the rSS, significantly improved the predictability of rSS for all-cause death. In the present study, we also found that the clinical rSS had best predictability of all-cause death. Because clinical rSS incorporated clinical factors with scoring system, this difference of predictability seemed logical. On the other hand, this study found that rSS had better predictability of repeat revascularization than clinical rSS; this finding revealed a clinical phenomenon that when interventionists gave a patient a repeat revascularization, anatomic rSS was the index they focused on.[16] However, both as anatomic IR indexes, the reason why rSS and SRI expressed significantly difference in predicting repeat revascularization was unclear.

Table 2: ROC: Predictive performance of outcomes with rSS, CrSS, and SRI

Items	rSS		CrSS		SRI		*P*		
	AUC (95% *CI*)	*P*	AUC (95% *CI*)	*P*	AUC (95% *CI*)	*P*	rSS versus CrSS	rSS versus SRI	CrSS versus SRI
All-cause death	0.56 (0.56–0.57)	0.03	0.59 (0.58–0.60)	0.03	0.56 (0.55–0.57)	0.03	<0.01	0.46	<0.01
Cardiac death	0.60 (0.59–0.61)	0.04	0.63 (0.62–0.64)	0.04	0.59 (0.58–0.60)	0.04	<0.01	0.18	<0.01
MI	0.55 (0.54–0.56)	0.03	0.56 (0.55–0.57)	<0.01	0.55 (0.54–0.56)	0.02	0.10	0.62	0.73
Revascularization	0.62 (0.61–0.62)	0.01	0.61 (0.60–0.62)	0.01	0.61 (0.60–0.62)	0.01	<0.01	<0.01	0.12
MACCE	0.60 (0.59–0.61)	0.01	0.60 (0.59–0.61)	0.01	0.60 (0.58–0.60)	0.01	0.45	<0.01	<0.01

rSS: Residual SYNTAX score; CrSS: Clinical residual SYNTAX score; SRI: SYNTAX revascularization index; MACCEs: Major adverse cardiovascular and cerebrovascular events; AUC: Area under ROC curve; *CI*: Confidence interval; ROC: Receiver operating characteristic; MI: Myocardial infarction.

However, when comparing the two IR cutoff values of rSS and SRI (rSS $\geq$ 8 vs. SRI <70%) directly, we found that their predictabilities of 2-year all-cause death, repeat revascularization, and MACCE were not different.

The present study has some limitations that should be acknowledged. First, the major limitation of this study is its nonrandomized design in which unmeasured confounders might affect any definitive conclusion. Second, 2-year follow-up duration is comparatively short to evaluate long-term outcomes. Third, rSS is based on angiographic interpretation that has inherent limitations,[23] and the results might have varied if the SS was assessed by less-trained readers. However, rSS was assessed by an independent angiographic core laboratory in this study; the good reproducibility for baseline SS evaluation has been demonstrated.[13] Third, previous studies have shown that patients with functional IR showed significantly higher rate of MACCE than those with functional CR.[24] In this study, we did not have data to discuss the effect of functional rSS on long-term outcomes. Finally, the patients in this study only included those underwent PCI treatment, and these IR indexes should be also validated in patients received coronary artery bypass grafting therapy.

In conclusion, in this large cohort of real-world patients underwent PCI treatment, all these IR indexes (rSS, clinical rSS, and SRI) were able to risk-stratify patients and predict 2-year composite adverse cardiovascular events after PCI. However, their prognostic capabilities were different. Clinical rSS is superior in predicting 2-year all-cause death than other two anatomic rSS and SRI, whereas rSS has superior predictability of repeat revascularization than clinical rSS and SRI.

Supplementary information is linked to the online version of the paper on the Chinese Medical Journal website.

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Conflicts of interest

There are no conflicts of interest.

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残余SYNTAX积分及其衍生积分对冠状动脉介入治疗术后患者预后影响的单中心大样本研究

摘要

背景： 残余SYNTAX积分 (rSS)及其衍生的SYNTAX血运重建指数(SRI)和临床残余SYNTAX积分 (CrSS)被用于评价不完全血运重建的程度。本研究在真实世界行冠状动脉介入治疗的大样本人群中，研究rSS, SRI及CrSS对不完全血运重建的评价价值以及其对患者远期预后的预测价值。

研究方法： 本研究连续纳入2013年1月至2013年12月在中国医学科学院阜外医院行冠状动脉介入治疗的患者。主要研究终点为全因死亡和主要心脑血管不良事件 (MACCE)。次要终点为再发心肌梗死、血运重建、卒中和支架内血栓。采用Kaplan-Meier法对临床终点进行生存分析，采用多因素COX回归分析比较三种积分与全因死亡的关系。使用受试者工作曲线比较三种不同积分对缺血事件的预测价值。

结果： 研究共纳入10,344例患者。Kaplan-Meier生存分析显示：rSS, SRI及CrSS评价的残余冠状动脉病变更重的患者，其缺血事件发生率更高。多因素分析显示：CrSS是全因死亡的独立危险因素 (*HR*: 1.02, 95% *CI*: 1.01–1.03; *P*<0.01)。受试者工作曲线比较分析显示：CrSS比rSS和SRI对全因死亡的预测价值更高 (AUC: 0.59 vs. 0.56 vs. 0.56, *P*< 0.01)，而rSS比CrSS和SRI对再次血运重建的预测价值更高(AUC: 0.62 vs. 0.61 vs. 0.61; *P*< 0.01)。rSS ≥ 8分和SRI< 70%对全因死亡的预测价值相当 (AUC: 0.54, 95% *CI*: 0.53–0.55 vs. AUC:0.57, 95% *CI*: 0.56–0.58, *P*= 0.21)。

结论： rSS, CrSS和SRI三个评分均可用于冠状动脉介入治疗术后患者2年预后的危险分层。CrSS对全因死亡有一定的预测价值，rSS对再次血运重建有一定的预测价值。

Supplementary Table 1: Baseline characteristics of all patients after PCI according to CrSS

Characteristics	CrSS = 0 (*n* = 5375)	0< CrSS ≤3.5 (*n* = 1667)	3.5< CrSS ≤7.9 (*n* = 1641)	CrSS >7.9 (*n* = 1661)	Statistical values	*P* for trend
Age (years)	57 ± 10	59 ± 10	59 ± 10	60 ± 10	141.01*	<0.01
Male	4140 (77.0)	1306 (78.3)	1290 (78.6)	1232 (74.2)	11.61†	<0.01
BMI (kg/m²)	25.9 ± 3.2	26.0 ± 3.2	25.9 ± 3.1	26.0 ± 3.1	1.76*	0.49
eGFR <90 ml/min	1871 (34.8)	542 (32.5)	637 (38.8)	895 (53.9)	222.74†	<0.01
LVEF <40 ml/min	17 (0.3)	6 (0.3)	7 (0.5)	9 (0.6)	40.57†	<0.01
Clinical history						
Diabetes mellitus	1398 (26.0)	582 (34.9)	538 (32.8)	590 (35.5)	89.99†	<0.01
Hypertension	3321 (61.8)	1110 (66.6)	1055 (64.3)	1155 (69.5)	38.34†	<0.01
Hyperlipidemia	3545 (66.0)	1172 (70.3)	1120 (68.3)	1105 (66.5)	12.19†	<0.01
Previous stroke	491 (9.1)	174 (10.4)	191 (11.6)	253 (15.2)	51.02†	<0.01
Peripheral vascular disease	121 (2.3)	41 (2.5)	49 (3.0)	59 (3.6)	9.58†	0.02
COPD	114 (2.1)	37 (2.2)	35 (2.1)	50 (3.0)	4.77†	0.19
Family history of CAD	1298 (24.2)	440 (26.4)	410 (25.0)	404 (24.3)	3.60†	0.31
Current smoker	3057 (56.9)	979 (58.7)	956 (58.3)	896 (53.9)	9.42†	0.02
Previous MI	884 (16.4)	279 (16.7)	347 (21.1)	411 (24.7)	68.79†	<0.001
Previous PCI	1203 (22.4)	399 (23.9)	439 (26.8)	475 (28.6)	32.89†	<0.001
Clinical presentation						
ACS	3334 (62.0)	983 (59.0)	941 (57.3)	979 (58.9)	12.68†	<0.01
Stable angina	1620 (30.1)	546 (32.8)	559 (34.1)	534 (32.1)		
Silent ischemia	421 (7.8)	138 (8.3)	141 (8.6)	148 (8.9)		
Angiographic and procedural characteristics						
CAD extension						
LM disease	131 (2.4)	37 (2.2)	50 (3.0)	38 (2.3)	2.95†	0.40
3-vessel disease	1228 (22.8)	815 (48.9)	989 (60.3)	1184 (71.3)	1659.30†	<0.01
Type of stents						
BMS	27 (0.5)	10 (0.6)	6 (0.4)	14 (0.8)	3.92†	0.27
DES	5198 (96.7)	1602 (96.1)	1537 (93.7)	1434 (86.3)	272.04†	<0.01
PTCA	104 (1.9)	33 (2.0)	41 (2.5)	52 (3.1)	9.37†	0.02
IVUS use	302 (5.6)	89 (5.3)	99 (6.0)	90 (5.4)	0.90†	0.83
IABP use	57 (1.1)	15 (0.9)	17 (1.0)	50 (3.0)	41.70†	<0.01
Procedural success	5329 (99.1)	1645 (98.7)	1584 (96.5)	1500 (90.3)	385.39†	<0.01
Baseline SYNTAX score	9.0 ± 6.5	11.3 ± 6.6	14.2 ± 6.3	20.8 ± 7.5	1381.2*	<0.01

The data are shown as mean ± SD or *n* (%). **F* value; †Chi-square value. BMI: Body mass index; eGFR: Estimated glomerular filtration rate; LVEF: Left ventricular ejection fraction; COPD: Chronic obstructive pulmonary disease; CAD: Coronary artery disease; MI: Myocardial infarction; PCI: Percutaneous coronary intervention; ACS: Acute coronary syndrome; BMS: Bare metal stent; DES: Drug-eluting stent; PTCA: Percutaneous transluminal coronary angioplasty; IVUS: Intravenous ultrasound; IABP: Intra-aortic balloon pump; CrSS: Clinical residual SYNTAX score; SD: Standard deviation; LM: Left main.

Supplementary Table 2: Baseline characteristics of all patients after PCI according to SRI

Characteristics	SRI = 100 (*n* = 5375)	100> SRI ≥66.7 (*n* = 1610)	66.7> SRI ≥38.9 (*n* = 1702)	SRI <38.9 (*n* = 1657)	Statistical values	*P* for trend
Age (years)	57 ± 10	59 ± 10	59 ± 10	60 ± 10	32.2*	<0.01
Male	4140 (77.0)	1237 (76.8)	1305 (76.7)	1286 (77.6)	0.47†	0.92
BMI (kg/m^2)	25.9 ± 3.2	26.0 ± 3.2	25.9 ± 3.1	26.0 ± 3.1	8.76*	0.46
eGFR <90 ml/min	1871 (34.8)	642 (39.9)	713 (41.9)	719 (43.4)	57.14†	<0.01
LVEF <40 ml/min	76 (1.4)	45 (2.8)	25 (1.5)	35 (2.1)	6.45†	0.09
Clinical history						
Diabetes mellitus	1398 (26.0)	571 (35.5)	578 (34.0)	561 (33.9)	88.01†	<0.01
Hypertension	3321 (61.8)	1097 (68.1)	1125 (66.1)	1098 (66.3)	30.22†	<0.01
Hyperlipidemia	3545 (66.0)	1106 (68.7)	1161 (68.2)	1130 (68.2)	6.91†	0.07
Previous stroke	491 (9.1)	185 (11.5)	224 (13.2)	209 (12.6)	31.90†	<0.01
Peripheral vascular disease	121 (2.3)	42 (2.6)	54 (3.2)	53 (3.2)	7.10†	0.07
COPD	114 (2.1)	33 (2.0)	42 (2.5)	47 (2.8)	3.56†	0.31
Family history of CAD	1298 (24.2)	403 (25.0)	419 (24.6)	432 (26.1)	2.59†	0.46
Current Smoker	3057 (56.9)	882 (54.8)	978 (57.5)	971 (58.6)	5.11†	0.16
Previous MI	884 (16.4)	321 (19.9)	335 (19.7)	381 (23.0)	40.85†	<0.01
Previous PCI	1203 (22.4)	358 (22.2)	452 (26.6)	503 (30.4)	52.19†	<0.01
Clinical presentation						
ACS	3334 (62.0)	940 (58.4)	1002 (58.9)	961 (58.0)	13.08†	<0.01
Stable angina	1620 (30.1)	539 (33.5)	562 (33.0)	538 (32.5)		
Silent ischemia	421 (7.8)	131 (8.1)	138 (8.1)	158 (9.5)		
Angiographic and procedural characteristics						
CAD extension						
LM disease	131 (2.4)	86 (5.3)	28 (1.6)	11 (0.7)	82.21†	<0.01
3-vessel disease	1228 (22.8)	890 (55.3)	1037 (60.9)	1061 (64.0)	1513.11†	<0.01
Type of stents						
BMS	27 (0.5)	5 (0.3)	10 (0.6)	15 (0.9)		0.12
DES	5198 (96.7)	1558 (96.8)	1626 (95.5)	1389 (83.8)		<0.01
PTCA	104 (1.9)	20 (1.2)	38 (2.2)	68 (4.1)	5.77†	0.12
IVUS use	302 (5.6)	146 (9.1)	75 (4.4)	57 (3.4)	430.08†	<0.01
IABP use	57 (1.1)	37 (2.3)	17 (1.0)	28 (1.7)	36.13†	<0.01
Procedural success	5329 (99.1)	1583 (98.3)	1674 (98.4)	1472 (88.8)	55.78†	<0.01
Baseline SYNTAX score	9.0 ± 6.5	16.5 ± 7.6	13.7 ± 7.7	16.1 ± 8.1	17.34†	<0.01

The data are shown as mean ± SD or *n* (%). **F* value; †Chi-square value. BMI: Body mass index; eGFR: Estimated glomerular filtration rate; LVEF: Left ventricular ejection fraction; COPD: Chronic obstructive pulmonary disease; CAD: Coronary artery disease; MI: Myocardial infarction; PCI: Percutaneous coronary intervention; ACS: Acute coronary syndrome; BMS: Bare metal stent; DES: Drug-eluting stent; PTCA: Percutaneous transluminal coronary angioplasty; IVUS: Intravenous ultrasound; IABP: Intra-aortic balloon pump; SRI: SYNTAX revascularization index; SD: Standard deviation; LM: Left main.