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# CatLet© Score for Estimation of Benefits of Percutaneous Coronary Intervention Versus Optimal Medical Therapy in Patients with Acute Myocardial Infarction

**Xin Xu[1], Yang He[2], Yong-Ming He[1*]**

## Abstract

**Background**: The recently developed Coronary Artery Tree description and Lesion EvaluaTion (CatLet©) angiographic scoring system has adequately accounted for the variability in coronary anatomy and considered both the severity of a coronary artery stenosis and its subtended myocardial territory. This study aims to investigate its potential roles played in guiding treatment strategies.

**Methods**: A total of 544 consecutive acute myocardial infarction (AMI) patients with single vessel disease were retrospectively enrolled and their CatLet scores were calculated. The patients were divided into two groups: high (≥10) versus low (<10) CatLet score group (n=367 versus n=177). The primary endpoint was all-cause death at four-year follow-up. Cox regression survival analysis was performed to determine the benefits of percutaneous coronary intervention (PCI) versus optimal medical therapy in each group.

**Results**: A total of 41 deaths occurred during the follow-up, accounting for 7.7%. The survival rate of all-cause death in the low CatLet score group was similar regardless of whether PCI was performed (P=0.86). However, in the high CatLet score group, the survival rate was significantly higher when PCI was performed as compared to those whose PCI was not performed (P = 0.0067). The multivariable-adjusted hazard ratios (95% CI, P) were 0.20 (0.07-0.62, P=0.005) for PCI in higher CatLet score group and 6.96 (0.22-205.65, P=0.277) in lower CatLet score group. **Conclusions**: The CatLet angiographic scoring system, capable to semi-quantify the myocardial territory, can be a useful tool to guide the treatment strategy for patients with AMI. Those with a CatLet score≥10 or more than five myocardial segments involved (CatLet score divided by the coefficient of 2) would benefit from the PCI strategy (http://www.chictr.org.cn; Registry Number: ChiCTR2000033730).

**Keywords**: CatLet angiographic scoring system; Percutaneous coronary intervention; Acute myocardial infarction

## Introduction

For acute myocardial infarction (AMI), an infarcted territory is closely associated with cardiac function and clinical outcomes. Identification of the infarcted territory can be achieved via echocardiography, magnetic resonance imaging, emission computed tomography, or contrasted computed tomographic angiography [1-3]. However, these methods are largely cumbersome or hard to determine a coronary-specific myocardial territory

**Affiliation:**

[1]Division of Cardiology, The First Affiliated Hospital of Soochow University, Suzhou, China

[2]Division of Emergency, The First Affiliated Hospital of Soochow University, Suzhou, China

***Corresponding author:**
Yong-Ming He, Division of Cardiology, The First Affiliated Hospital of Soochow University, Suzhou, China.

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in clinical practice. Most recently, we have developed the Coronary Artery Tree description and Lesion EvaluaTion (CatLet©) angiographic scoring system, in which we can obtain the myocardial territory subtended by a coronary artery according to the dynamic combinations of the left anterior descending artery, diagonal, and right coronary artery rather than the usually fixed distributions of coronary arteries as employed in the jeopardy score, Gensini score, and SYNTAX (Synergy Between PCI With Taxus and Cardiac Surgery) score [4-6]. The CatLet angiographic scoring system has thus provided 54 preset coronary circulation patterns to reflect coronary anatomy in its diversity and in its corresponding subtended myocardial territories [7,8]. Our prior studies have demonstrated that the CatLet angiographic scoring system can be utilized to predict clinical outcomes for patients with AMI with a high reproducibility [9-13]. A head-to-head comparison study has even demonstrated that the CatLet angiographic scoring system is superior to the SYNTAX score with respect to outcome predictions for patients with AMI [13]. Therefore, we hypothesized that the CatLet angiographic scoring system, capable to the coronary-specific myocardial territory, can be used to guide treatment strategy for patients with AMI.

## Materials and Methods

### Patients

Consecutive patients with AMI, aged 18 years old or over, arriving later than 12 hours after symptom onset, were retrospectively enrolled between January 1, 2012, and September 30, 2015. All of them had only major epicardial coronary artery disease (left anterior descending artery, left circumflex, or right coronary artery). These patients were orally administrated with dual antiplatelet therapy, statins, angiotensin-converting enzyme inhibitor/angiotensin receptor blockade or beta-blockers. The percutaneous coronary intervention (PCI) was performed via radial access by operators with at least 10 years of working experience. A culprit lesion with a diameter stenosis of more than 50% was usually treated via PCI procedure. The drug-eluted stents were routinely used in daily practice. In this institution, immediate PCI (<2 h) is usually performed for patients at very high risk. Patients at high risk usually underwent PCI within 24 h while those at intermediate or low risk usually underwent PCI within 72 h [14]. The dual antiplatelet therapy lasted at least one year unless contraindicated otherwise, and the single antiplatelet therapy (aspirin or clopidogrel) maintained indefinitely. The exclusion criteria were as follows: (1) poor image quality; (2) coronary artery embolism; (3) abnormal coronary anatomy; (4) normal or <50% diameter stenosis of coronary angiography (CAG) results; (5) multi-vessel disease and left main coronary artery disease; and (6) loss to follow-up. Patients gave the written informed consent. This study complied with the Declaration of Helsinki regarding investigation in humans and was approved by the Institutional Review Board of Soochow University (No.2023426).

### Data collection and definitions

The collected data included laboratory examinations, lifestyles, prior medical histories, and diseased coronary arteries. For patients with multiple hospitalizations, data from the first admission were collected, and for hospitalized patients with multiple laboratory examinations, data from the first examination were collected. Lifestyles considered were smoking and alcohol consumption. Current smokers were defined as those who smoked any tobacco in the previous 1 year or those who had quit within half a year. Past smokers were defined as those who had quit more than half a year earlier. Current alcohol consumers were defined as those who drank at least once a week in the previous 6 months. Past alcohol consumers were defined as those who had been abstinent in alcohol intake >6 months earlier. Diagnosis of hypertension or type 2 diabetes mellitus has been according to acknowledged standards.

### Lab examinations

All patients underwent 8-hour fasting blood tests in the morning. Tests for albumin (Alb), triglycerides (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), lipoprotein(a) (Lp(a)), and creatinine (Cr) were performed on Siemens 2400 bio-chemical analyzers following the manufacturer's specifications. Height and weight measurements were taken without shoes, with patients wearing light clothings. Body mass index (BMI) was calculated as body weight (in kilograms) divided by height (in meters) squared.

### Scoring method

The CatLet score system has been described in detail elsewhere [13,15]. In brief, it is a novel scoring system that aims to adequately account for coronary variability and stratify the risk of patients with coronary artery disease. Subsequent study showed that this novel scoring system can also be used to estimate the myocardial territory in jeopardy solely based on CAG results [16]. In the CatLet score system, the left anterior descending artery (LAD) and diagonal branches (Dx) were classified into three types, while the right coronary artery (RCA) was classified into six types. This resulted in a total of 54 (3×3×6) patterns of coronary circulation. Weighting factors were assigned to each coronary segment based on its subtended myocardial territory. Lesions with diameter stenosis greater than 50% in vessels larger than 1.5 mm were scored. For lesions with 50-99% diameter stenosis, a coefficient of 2.0 was assigned, while total occlusions were assigned a coefficient of 5.0. Non-occlusive lesions were scored directly, while in cases where the infarct-related artery was completely occluded, wiring or the use of a small balloon was employed to reveal the downstream lesion anatomy [17]. Persistently poor blood flow that prevented adequate visualization of the lesion was scored as a total occlusion. An individual lesion score is

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a product of the coefficient of the lesion and its weighting factor, and the total score is the sum of individual lesion scores. Thus, for a total occlusion lesion, three types of total score will produce: in total occlusion status, where coronary blood flow has been completely occluded revealed in the CAG exam; in non-occlusion status, where coronary blood flow has partially recovered after pretreatment with a small balloon; in "normal" status, where coronary blood flow has recovered to normal after PCI. For a non-occlusion lesion, two types of total score will produce: in partial occlusion status and "normal" status, where the definitions were the same as the aforementioned. In the current study, the CatLet score in partial occlusion status was used for final analysis. The CatLet score calculator is available at www.catletscore.com. A representative case has been illustrated to show how the CatLet score is performed as in Figure 1.

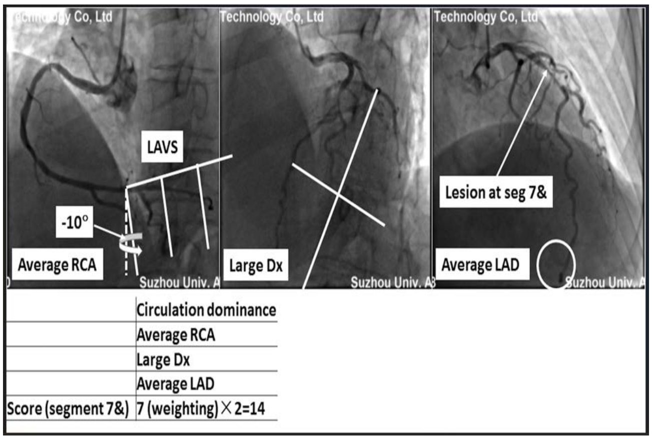


**Figure 1:** Calculation of the CatLet score in a representative case. According to the algorithm of the CatLet score, RCA distributed around the first two thirds of LAVS length, Dx distributed over more than four quadrants, and LAD reached the apex. Thus, the coronary circulation dominance is average RCA, large Dx, and average LAD, and the segment 7&'s (proximal LAD) weighting of 7 can be obtained at www.catletscore.com or mental calculation. The dashed line starting at the crux cordis indicates the posterior interventricular sulcus at 6 O'clock in the RCA view of left anterior oblique 45° . In a RCA view of left anterior oblique 35°, a counterclockwise rotation of 10° is a must to obtain the solid line, to which two other solid lines are parallel to divide the LAVS into three even parts. A non-occlusive lesion in segment 7& will be scored as 7×2=14. RCA=right coronary artery; Dx=diagonals; LAD=left anterior descending artery; seg=segment; and LAVS=left atrioventricular sulcus [7,8].

### Cutoff of the CatLet score

Our previous study demonstrated that a 50-70% diameter stenosis of a coronary artery would lead to its subtended five myocardial segments (the CatLet score≥10) at risk of ischemia as confirmed by fractional flow reserve (FFR)≤0.8 [16]. Patients in the current study were thus grouped according to the CatLet score value of 10.

### Endpoint, definitions, and follow-ups

The primary endpoint of this study was all-cause death, defined as death from any cause. AMI was defined according to the third universal definition of myocardial infarction [18]. Follow-up was conducted through telephone interviews with living patients or their immediate relatives. Interviews were conducted until the date of death or the end of the study (September 2019), whichever came first. Medical records, discharge summaries, and angiographic data were systematically reviewed in case of adverse events. Death information was obtained from household registration management systems, hospitals, or their immediate relatives.

### Statistical analysis

The normality of continuous variables was assessed using the Shapiro-Wilk test, which indicated that all the variables did not conform to a normal distribution. Therefore, continuous variables were compared using the rank-sum test and expressed as median (interquartile range, IQR). Categorical variables were compared using the likelihood-ratio chi-squared test and expressed as frequencies (percentages). Multiple imputation methods (Chained equations, 10 times) were used to deal with the missing values. Event-free survival curves were generated using the Kaplan-Meier method, and survival between groups was compared using the Log rank trend test. Cox regression survival analysis was performed to examine the association of CatLet score with all-cause death. The survival data were censored at 4 years since admission due to different follow-up periods. All statistical analyses were performed using Stata version 17.0 (State Corp LP, College Station, TX, USA). All *P*-values and confidence intervals were two-sided and a *P* value of <0.05 was considered statistically significant.

## Results

### Baseline characteristics of the study subjects

All subjects were divided into two groups based on their CatLet scores: CatLet≥10 and CatLet<10. The total number of patients included in the study was 544, with 177 patients in the low score group and 367 patients in the high score group as detailed in Figure 2. The baseline data were largely comparable between both groups. Patients with the high CatLet score had significantly lower LVEF (*P*=0.011). Diseased LADs were more frequently seen in both groups. A total of 351 (95.6%) patients received the PCI treatment in the high CatLet score group while a total of 162 (91.5%) patients received the PCI treatment in the low CatLet score group, with an insignificant trend towards to be more likely to receive PCI procedure in the high CatLet score (*P*=0.052). Details can be found in Table 1. Table S1 presented the background comparison of those who received the PCI procedure or not.

**Table 1:** Baseline characteristics of study participants grouped by low (<10) or high (≥10) CatLet score.

| Factors | Missing | CatLet<10 | CatLet≥10 | *P*-Values |
|---|---|---|---|---|
| N | | 177 | 367 | |
| Male, n (%) | | 144(81.36) | 294(80.10) | 0.73 |
| Age (IQR) | | 63(20) | 64(19) | 0.71 |
| Height, cm | 2.57% | 165 (160, 170) | 168 (161, 170) | 0.25 |
| Weight, kg | 11.40% | 65 (59, 75) | 68 (60, 75) | 0.17 |
| BMI, kg/m2 | | 23.88(5.18) | 24.09(3.98) | 0.34 |
| Smoking, n (%) | | | | 0.63 |
| Never | | 57(32.2) | 133(36.2) | |
| Past | | 16(9.0) | 29(7.9) | |
| Current | | 104(58.8) | 205(55.9) | |
| Drinking, n (%) | | | | 0.27 |
| Never | | 117(66.1) | 266(72.5) | |
| Past | | 5(2.8) | 11(3.0) | |
| Current | | 55(31.1) | 90(24.5) | |
| Hypertension, n (%) | | 107(60.5) | 211(57.5) | 0.51 |
| Diabetes, n (%) | | 32(18.1) | 72(19.6) | 0.67 |
| Albumin, g/L | 0.74% | 39.30(4.90) | 38.95(5.70) | 0.29 |
| TG, mmol/L | 0.37% | 1.16(0.97) | 1.28(0.91) | 0.47 |
| TC, mmol/L | 0.37% | 3.99(1.32) | 3.96(1.25) | 0.62 |
| Lp(a), mg/L | 5.33% | 97(99.5) | 104(199) | 0.34 |
| LDL-C, mmol/L | 0.74% | 2.40(0.90) | 2.47(0.94) | 0.99 |
| Creatinine, µmol/L | 0.55% | 71(21.50) | 71(23.20) | 0.36 |
| LVEF, % | 5.33% | 56(16) | 53(18) | 0.011 |
| STMEI | | 91(16.73) | 202(37.13) | 0.043 |
| PCI, n (%) | | 162(91.5) | 351(95.6) | 0.052 |
| Treated coronary lesion | | | | |
| LAD, n (%) | | 87(49.2) | 214(58.3) | 0.044 |
| LCX, n (%) | | 40(22.6) | 40(10.9) | <0.001 |
| RCA, n (%) | | 35(19.8) | 97(26.4) | 0.09 |
| All-cause death, n (%) | | 11(6.2) | 31(8.4) | 0.36 |

**Notes:** IQR=inter quartile range; TG=triglyceride; TC=total cholesterol; LP(a)=lipoprotein(a); LDL-C=low-density lipoprotein cholesterol; LVEF=left ventricular ejection fraction; BMI=body mass index; STMEI=ST-segment elevation myocardial infarction; PCI=percutaneous coronary intervention; LAD=left anterior descending artery; LCX=left circumflex artery; and RCA=right coronary artery. Continuous variables were expressed as median (IQR); categorical variables were expressed as frequency and percentage.

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### CatLet score and its associations with 4-year all-cause death

In the low CatLet score, the survival rate of all-cause death was similar regardless of whether PCI was performed (P = 0.86). However, in the high CatLet score group, the survival rate was higher when PCI was performed as compared to those whose PCI was not performed (P = 0.0067) as shown in Figure 3. When adjusting for age, sex, BMI, smoking, alcohol consumption, hypertension, diabetes, albumin, triglycerides, total cholesterol, serum creatinine, and LVEF, PCI reduced all-cause deaths by 66% (HR (95%CI), 0.34(0.13-0.94), *P*=0.038). Regarding the PCI procedure, the multivariable-adjusted hazard ratios (95% CI) were 6.96 (0.22-205.65) for the low score group and 0.20(0.07-0.62) for the high score group (P =0.005). These results suggest that AMI patients with a high CatLet score benefit from PCI. Further details can be found in Table 2 and Table S2.

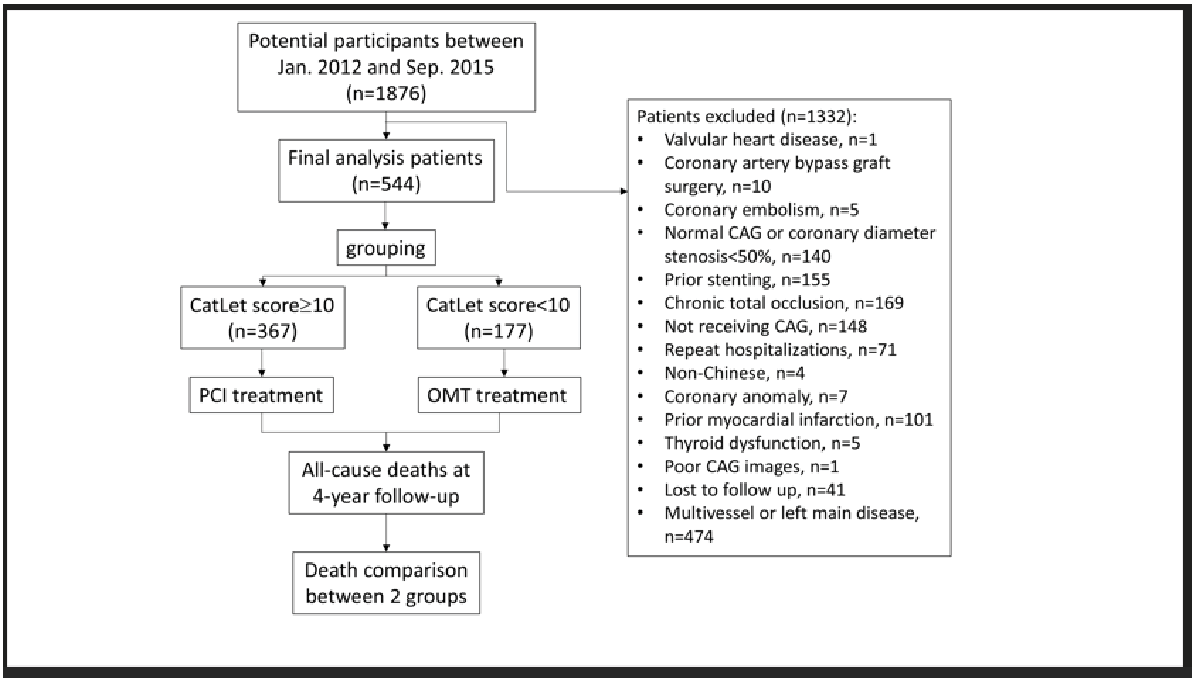


**Figure 2:** Flowchart of patient enrollment. PCI= percutaneous coronary intervention, OMT=optimal medical therapy, and CAG=coronary angiography.

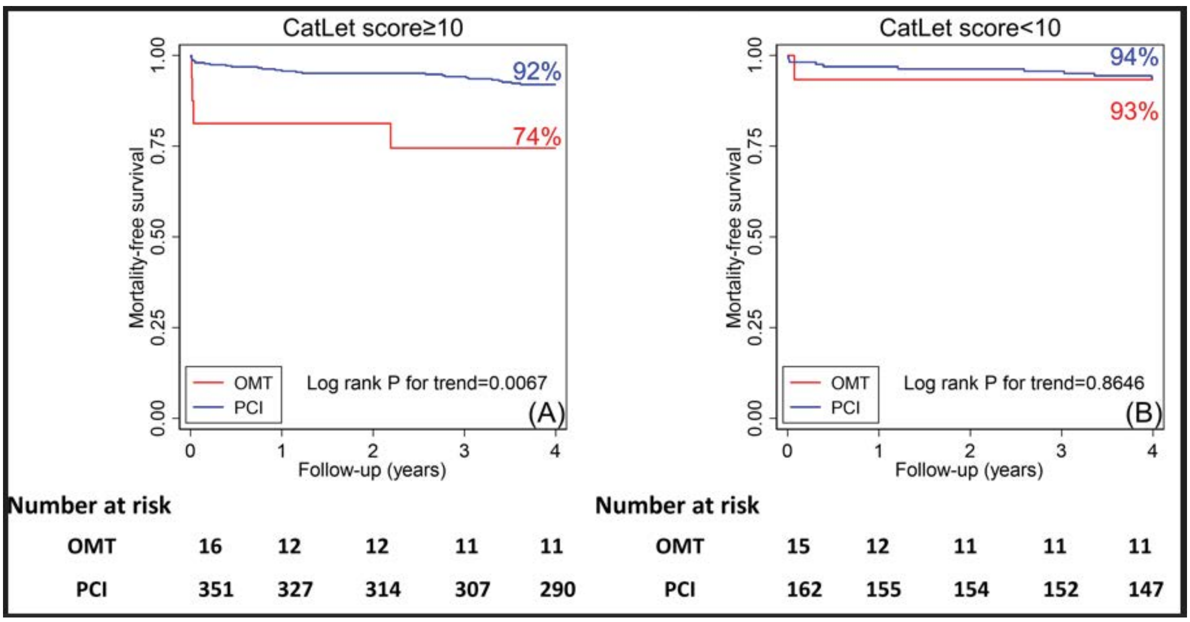


**Figure 3:** Kaplan–Meier curves for all-cause death at 4 years according to receiving PCI versus OMT treatment in the CatLet score ≥10 (Figure 3A) versus CatLet score<10 (Figure 3B). PCI=percutaneous coronary intervention, and OMT=optimal medical therapy.

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### Sensitivity analysis

Sensitivity analysis revealed a consistent benefit from PCI in high CatLet score by multivariable analysis with LVEF and lipoprotein(a) removed one by one (Table S3-S4).

**Table 2:** Multivariable-adjusted hazard ratios for PCI in patients with CatLet score less than versus greater than 10.

| Treatment | CatLet<10 | | CatLet≥10 | |
|---|---|---|---|---|
| | HR (95%CI) | *p* Values | HR (95%CI) | *p* Values |
| §PCI | 0.83(0.11-6.54) | 0.865 | 0.26(0.09-0.74) | 0.012 |
| ¶PCI | 6.69(0.22-205.65) | 0.277 | 0.20(0.07-0.62) | 0.005 |

**Notes:** §PCI, denotes no adjustment of any risk factors; ¶PCI, adjusted for age, sex, body mass index, smoke, drinking, hypertension, diabetes, albumin, triglyceride, total cholesterol, creatinine, and left ventricular ejection fraction; HR (95%CI), hazard ratio (95% confidence interval).

## Discussion

To the best of our knowledge, this is the first study to validate that the CatLet score can be a useful tool to guide the treatment strategy for patients with AMI. The key findings of the current study include: (i) AMI patients with a higher CatLet score (≥10 or five segments) can benefit from PCI; and (ii) there are no significant differences in survival rate in patients with a low CatLet score (<10) receiving or not receiving PCI.

In univariate analysis, baseline characteristics were largely comparable between two groups except LVEF, where the lower LVEF was associated with the higher CatLet score. Competitive blood supply to left ventricle, 17-myocardial segmental model, and flow conservation formed the basis of the CatLet angiographic scoring system, which can be utilized to semi-quantify myocardial territory subtended by a coronary artery [8,15]. The higher CatLet score indicated a broader myocardial territory in jeopardy. It thus makes sense that patients with higher CatLet score had a lower LVEF value.

Two or three-vessel disease could interacted with each other and how these interactions had impacts on clinical outcomes were hard to be identified [19]. Therefore, in the current study, patients with one-vessel disease were enrolled and those with two or three-vessel diseases were excluded. Left main was also taken as multi-vessel disease and was thus excluded from this study.

In the current study, those with higher CatLet score benefited from PCI, but those with lower CatLet score did not. The CatLet score is the first of its kind that has explained the coronary anatomy in its diversity, graded the severity of a coronary lesion, and reflected the myocardial territory subtended by the diseased coronary artery. Thus, the key findings that those with higher CatLet score benefited from PCI, but those with lower CatLet score did not in the current study are wholly anticipated. Of note, in patients with CatLet score <10, stenting had a trend towards being a protective factor in the univariate analysis. However, stenting changed to be a hazard risk of 6.96 (95%CI, 0.22-205.65) in multivariable analysis albeit also without statistical significances. This indicated that it may be hazardous to stent an AMI patient with a low CatLet score, which are deserving of further study. Attention has to be paid to the wide confidence interval of the stenting in the low CatLet score group, suggesting a lack of statistical power and raising concerns about the reliability of these estimates. A large sample size study is warranted to further validate this preliminary finding. The SYNTAX score, another anatomic angiographic scoring system, has been widely validated and recommended for risk-stratification and decision-making on patients with coronary artery diseases [20-24]. The SYNTAX score in part reflected the blood supply territory of the left heart although it is far from being adequate in this regard as compared to the CatLet score. It is also not surprising that patients with higher SYNTAX score will benefit from PCI and that patients with lower SYNTAX score will not [25,26]. The CatLet angiographic scoring system, however, has remained completely different clinical implications: identification of a coronary-specific myocardial territory in jeopardy solely based on the angiograms of coronary angiography. Previous studies demonstrated that myocardial territory in jeopardy is closely associated with patients' outcomes [27,28].

More than 50-70% diameter stenosis will lead to its subtended six segments (17 myocardial segment model) at risk of ischemia as confirmed by FFR≤0.80 [29,30]. Our previous study revealed that a 50-70% diameter stenosis led to its subtended five segments at risk of ischemia as confirmed by FFR≤0.80 [16]. Therefore, choice of a cutoff of the CatLet score at 10 (corresponding to five segments involved) in the current study is more conservative and will put more patients in a safe place.

## Limitations

There are several limitations to our study. First, this study is retrospective in design and the results should be considered as hypothesis-generating. Prospective, randomized controlled trials would provide stronger evidence. Second, a retrospective study is open to confounders, which may bias our findings. However, covariates were collected as possible as we can to minimize these possible bias. The multivariable analysis still did not alter our key findings. Third, our study only included AMI patients with one-vessel disease. Whether or not the key findings in the current study are replicated in other coronary populations remains to be clarified. Lastly, sample size is moderate. A large sample-size study will be powered to elucidate the value of CatLet score in guiding the revascularization strategy.

## Conclusions

The CatLet angiographic scoring system, capable to estimate a coronary-specific myocardial territory in jeopardy, can be a useful tool to guide the revascularization strategy for patients with AMI. For a lesion with 50-70% luminal reduction, more than or equal to five segments in jeopardy will benefit from revascularization strategy. This finding warrants further investigation in the context of a prospective, randomized controlled trial.

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## Data Availability Statement

Data are provided within supplementary information files. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Author contributions

X.X. and Y.-M.H. wrote the main manuscript text, Y.H. collected the data and prepared the Tables and Figure and Y.-M.H. reviewed the manuscript.

**Competing interests:** The authors declare no competing interests.

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**Table S1:** Background comparison of those who received the PCI procedure or not.

| Factor | Level | OMT | PCI | *p* Value |
|---|---|---|---|---|
| N | | 31 | 513 | |
| Age (years), median (IQR) | | 60 (54, 72) | 64 (53, 72) | 0.52 |
| Sex (1=female, 2=male) | Female | 7 (22.6%) | 99 (19.3%) | 0.65 |
| | Male | 24 (77.4%) | 414 (80.7%) | |
| Creatinine, µmol/L, median (IQR) | | 68.6 (60, 87) | 71 (61, 83.2) | 0.75 |
| Lp(a), mg/L, median (IQR) | | 85 (36, 196.5) | 103 (49, 232) | 0.39 |
| Primary Hypertension, n (%) | | 20 (64.5%) | 298 (58.1%) | 0.48 |
| Type 2 diabetes mellitus, n (%) | | 8 (25.8%) | 96 (18.7%) | 0.33 |
| Smoking, n (%) | Never | 12 (38.7%) | 178 (34.7%) | 0.87 |
| | Past | 2 (6.5%) | 43 (8.4%) | |
| | Current | 17 (54.8%) | 292 (56.9%) | |
| Alcohol intake, n (%) | Never | 25 (80.6%) | 358 (69.8%) | 0.39 |
| | Past | 1 (3.2%) | 15 (2.9%) | |
| | Current | 5 (16.1%) | 140 (27.3%) | |
| LDL-C, mmol/L, median (IQR) | | 2.44 (2.1, 3.03) | 2.44 (2.06, 2.99) | 0.63 |
| HDL-C, mmol/L, median (IQR) | | 0.9 (0.9, 1) | 0.97 (0.9, 1.12) | 0.08 |
| TG, mmol/L, median (IQR) | | 1.39 (0.91, 3.47) | 1.24 (0.87, 1.78) | 0.12 |
| TC, mmol/L, median (IQR) | | 4.03 (3.19, 4.81) | 3.96 (3.37, 4.64) | 0.53 |
| Albumin, g/L, median (IQR) | | 40.6 (35.8, 42.1) | 39.1 (36.1, 41.5) | 0.33 |
| LVEF, median (IQR) | | 0.58 (0.47, 0.65) | 0.55 (0.45, 0.62) | 0.09 |
| Stented | OMT | 31 (100.0%) | 0 (0.0%) | <0.001 |
| | PCI | 0 (0.0%) | 513 (100.0%) | |
| Treated LCX, n (%) | 0 | 31 (100.0%) | 433 (84.4%) | 0.017 |
| | 1 | 0 (0.0%) | 80 (15.6%) | |
| Treated LAD, n (%) | 0 | 31 (100.0%) | 212 (41.3%) | <0.001 |
| | 1 | 0 (0.0%) | 301 (58.7%) | |
| Treated RCA, n (%) | 0 | 31 (100.0%) | 381 (74.3%) | 0.001 |
| | 1 | 0 (0.0%) | 132 (25.7%) | |
| Treated LM, n (%) | 0 | 31 (100.0%) | 513 (100.0%) | |
| All-cause death at 4 years | | 5 (16.1%) | 37 (7.2%) | 0.071 |

**Notes:** IQR, inter quartile range; TG, triglyceride; TC, total cholesterol; LP (a), lipoprotein(a); LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; LVEF, left ventricular ejection fraction; OMT, optimal medical therapy; PCI, percutaneous coronary intervention; LM, left main artery; LAD, left anterior descending artery; LCX, left circumflex artery; and RCA, right coronary artery.

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**Table S2:** Multivariable adjusted hazard ratios for PCI in patients with one-vessel disease.

| Factors | HR | SE. | t | *p* Value | 95% CI |
|---|---|---|---|---|---|
| PCI, n | 0.35 | 0.18 | -2.05 | 0.041 | 0.13-0.96 |
| Age, year | 1.03 | 0.018 | 1.66 | 0.097 | 0.99-1.06 |
| Sex, n | 0.60 | 0.25 | -1.23 | 0.219 | 0.27-1.35 |
| BMI, kg/m2 | 1.10 | 0.049 | 2.16 | 0.031 | 1.009-1.20 |
| Smoking, n | 0.93 | 0.20 | -0.32 | 0.751 | 0.61-1.42 |
| Drinking, n | 0.65 | 0.17 | -1.61 | 0.107 | 0.39-1.10 |
| Hypertension, n | 0.74 | 0.27 | -0.82 | 0.415 | 0.36-1.53 |
| Diabetes, n | 2.31 | 0.81 | 2.38 | 0.017 | 1.16-4.60 |
| Albumin, g/L | 0.91 | 0.032 | -2.54 | 0.011 | 0.85-0.98 |
| TG, mmol/L | 0.54 | 0.19 | -1.74 | 0.082 | 0.27-1.08 |
| TC, mmol/L | 0.99 | 0.19 | -0.07 | 0.943 | 0.68-1.42 |
| Creatinine, µmol/L | 1.01 | 0.0048 | 2.38 | 0.017 | 1.002-1.02 |
| LVEF | 0.0021 | 0.0037 | -3.57 | <0.001 | 0.000072-0.062 |
| Lilpoprotein(a) | 1.00 | 0.00087 | -0.69 | 0.489 | 0.99-1.001 |

**Notes:** HR, hazard ratios; SE, standard error; 95%CI, 95% confidence interval; TG, triglyceride; TC, total cholesterol; LVEF, left ventricular ejection fraction; BMI, body mass index; and PCI, percutaneous coronary intervention.

**Table S3:** Multivariable adjusted hazard ratios for PCI in patients without lilpoprotein(a).

| Factors | HR | SE. | t | *p* Value | 95% CI |
|---|---|---|---|---|---|
| PCI, n | 0.35 | 0.18 | -2.07 | 0.038 | 0.13-0.94 |
| Age, year | 1.03 | 0.017 | 1.63 | 0.103 | 0.99-1.06 |
| Sex, n | 0.59 | 0.24 | -1.28 | 0.199 | 0.26-1.32 |
| BMI, kg/m2 | 1.10 | 0.049 | 2.12 | 0.034 | 1.0072-1.20 |
| Smoking, n | 0.93 | 0.20 | -0.32 | 0.748 | 0.61-1.42 |
| Drinking, n | 0.65 | 0.17 | -1.62 | 0.106 | 0.39-1.10 |
| Hypertension, n | 0.74 | 0.27 | -0.83 | 0.407 | 0.36-1.52 |
| Diabetes, n | 2.31 | 0.81 | 2.39 | 0.017 | 1.16-4.60 |
| TG, mmol/L | 0.54 | 0.19 | -1.73 | 0.084 | 0.27-1.086 |
| TC, mmol/L | 0.95 | 0.17 | -0.25 | 0.799 | 0.67-1.36 |
| Albumin, g/L | 0.92 | 0.032 | -2.51 | 0.012 | 0.85-0.98 |
| Creatinine, µmol/L | 1.01 | 0.0047 | 2.34 | 0.019 | 1.0018-1.02 |
| LVEF | 0.0024 | 0.0040 | -3.54 | <0.001 | 0.000083-0.067 |

**Notes:** HR, hazard ratios; SE, standard error; 95%CI, 95% confidence interval; TG, triglyceride; TC, total cholesterol; LVEF, left ventricular ejection fraction; BMI, body mass index; and PCI, percutaneous coronary intervention.

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**Table S4:** Multivariable adjusted hazard ratios for PCI in patients without LVEF.

| Factors | HR | SE. | t | *p* Value | 95% CI |
|---|---|---|---|---|---|
| PCI, n | 0.36 | 0.18 | -2.03 | 0.042 | 0.14-0.96 |
| Age, year | 1.035 | 0.018 | 1.95 | 0.051 | 0.99-1.07 |
| Sex, n | 0.58 | 0.23 | -1.36 | 0.175 | 0.26-1.28 |
| BMI, kg/m2 | 1.09 | 0.048 | 2 | 0.046 | 1.002-1.19 |
| Smoking, n | 0.96 | 0.20 | -0.19 | 0.848 | 0.63-1.46 |
| Drinking, n | 0.71 | 0.19 | -1.29 | 0.197 | 0.42-1.20 |
| Hypertension, n | 0.72 | 0.26 | -0.9 | 0.37 | 0.35-1.48 |
| Diabetes, n | 2.44 | 0.84 | 2.58 | 0.01 | 1.24-4.81 |
| TG, mmol/L | 0.46 | 0.16 | -2.17 | 0.03 | 0.23-0.93 |
| TC, mmol/L | 0.98 | 0.18 | -0.1 | 0.924 | 0.69-1.41 |
| Albumin, g/L | 0.89 | 0.031 | -3.41 | 0.001 | 0.83-0.95 |
| Creatinine, μmol/L | 1.01 | 0.0048 | 2.31 | 0.021 | 1.002-1.02 |
| Lilpoprotein(a), mg/L | 1.00 | 0.00088 | -0.43 | 0.671 | 0.99-1.001 |

Notes: HR, hazard ratios; SE, standard error; 95%CI, 95% confidence interval; TG, triglyceride; TC, total cholesterol; LVEF, left ventricular ejection fraction; BMI, body mass index; and PCI, percutaneous coronary intervention.