

## Performance Metrics

In the current study, the following metrics were applied to evaluate the performance of each model.

- i.) True positives (TPs), positive diagnoses classified as positive outcomes.
- ii.) False positives (FPs), negative diagnoses classified as positive outcomes.
- iii.) True negatives (TNs), negative diagnoses classified as negative outcomes.
- iv.) False negatives (FNs), positive diagnoses classified as negative outcomes.
- v.) The learning curve, adopted to assess classification performance (*Figure S3*).
- vi.) Accuracy, the ability to correctly classify the dataset

$$Accuracy = \frac{TP + TN}{TP + FP + TN + FN} \quad (1)$$

- vii.) True positive rate (TPR), or Sensitivity

$$TPR = Recall = Sensitivity = \frac{TP}{TP + FN} \quad (2)$$

- viii.) False positive rate (FPR), or type I error probability

$$FPR = FP / (FP + TN) \quad (3)$$

- ix.) True negative rate (TNR), or Specificity

$$Specificity = TNR = \frac{TN}{TN + FP} = 1 - FPR \quad (4)$$

- x.) Precision

$$Precision = \frac{TP}{TP + FP} \quad (5)$$

- xi.) Receiver operating characteristic (ROC) curve, a curve determined by plotting TPR and FPR and used for evaluating the model performance.
- xii.) Area under the curve (AUC), an index used to evaluate the predictive and classification performance of a model.
- xiii.) Gini coefficient, used to measure the performance of a model.

$$Gini = 2 * AUC - 1 \quad (6)$$

**Table S1** Differences between demographic and clinical characteristics of CS and non-CS groups

Variables	Total (n=2282)	Noncardiogenic shock (n=2,112)	Cardiogenic shock (n=170)	P value
<b>Demographic</b>				
Age, median (IQR)	64.0 (53.0, 73.0)	64.0 (53.0, 72.0)	70.0 (62.2, 77.0)	<0.001
Sex, n (%)				<0.001
Female	598 (26)	534 (25)	64 (38)	
Male	1684 (74)	1578 (75)	106 (62)	
Smoker, n (%)				0.021
No	839 (37)	762 (36)	77 (45)	
Yes	1443 (63)	1350 (64)	93 (55)	
NWD on admission, n (%)				0.109
No	1426 (62)	1330 (63)	96 (56)	
Yes	856 (38)	782 (37)	74 (44)	
Delay, n (%)				<0.001
FMC ≥12 hours	1716 (75)	1612 (76)	104 (61)	
FMC <12 hours	566 (25)	500 (24)	66 (39)	
<b>Electrocardiographic data</b>				
Inferior wall, n (%)				
No	1326 (58)	1221 (58)	105 (62)	
Yes	956 (42)	891 (42)	65 (38)	
Anterior wall, n (%)				0.304
No	1073 (47)	1000 (47)	73 (43)	
Yes	1209 (53)	1112 (53)	97 (57)	
Right ventricular, n (%)				0.51
No	2250 (99)	2081 (99)	169 (99)	
Yes	32 (1)	31 (1)	1 (1)	
Other, n (%)				0.009
No	2224 (97)	2064 (98)	160 (94)	
Yes	58 (3)	48 (2)	10 (6)	
<b>Medical history</b>				
Hypertension, n (%)				0.469
No	1155 (51)	1074 (51)	81 (48)	
Yes	1127 (49)	1038 (49)	89 (52)	
Diabetes mellitus, n (%)				0.216
No	1872 (82)	1739 (82)	133 (78)	
Yes	410 (18)	373 (18)	37 (22)	
Stroke, n (%)				0.941
No	2144 (94)	1985 (94)	159 (94)	
Yes	138 (6)	127 (6)	11 (6)	
CKD, n (%)				< 0.001
No	2060 (90)	1926 (91)	134 (79)	
Yes	222 (10)	186 (9)	36 (21)	
<b>Vital signs on admission</b>				
Shock index, median (IQR)	0.6 (0.5, 0.7)	0.6 (0.5, 0.7)	0.7 (0.6, 1.0)	<0.001
HR, median (IQR), beats/min	80.0 (71.0, 90.0)	79.0 (71.0, 90.0)	86.0 (74.2, 105.0)	<0.002
SBP, median (IQR), mmHg	126.0 (110.0, 140.0)	126.0 (111.0, 140.0)	115.0 (99.0, 136.0)	<0.003
DBP, median (IQR), mmHg	80.0 (70.0, 90.0)	80.0 (70.0, 90.0)	75.5 (63.0, 86.0)	<0.004
<b>Laboratory on admission</b>				
WBC, median (IQR), ×10 <sup>9</sup> /L	10.5 (8.2, 13.3)	10.4 (8.0, 13.1)	12.4 (9.5, 16.4)	<0.001
Neutrophil count, median (IQR), ×10 <sup>9</sup> /L	8.3 (5.8, 11.0)	8.1 (5.7, 10.8)	10.3 (7.4, 13.6)	<0.001
NLR, median (IQR)	6.2 (3.7, 10.5)	6.2 (3.6, 9.9)	8.4 (4.7, 14.1)	<0.001
PLR, median (IQR)	157.0 (109.4, 224.8)	157.4 (110.7, 223.6)	152.4 (95.0, 253.1)	0.681
MLR, median (IQR)	0.5 (0.4, 0.8)	0.5 (0.4, 0.8)	0.6 (0.4, 1.0)	<0.001
SIRI, median (IQR)	4.2 (2.3, 7.3)	4.0 (2.3, 7.0)	6.0 (3.5, 11.2)	<0.001
SII, median (IQR)	1248.5 (705.2, 2167.0)	1234.3 (701.1, 2111.0)	1564.6 (787.9, 2814.4)	0.001
HB, median (IQR)	137.0 (123.0, 150.0)	138.0 (124.0, 151.0)	128.0 (111.0, 142.0)	<0.001
RBC, median (IQR), ×10 <sup>12</sup> /L	4.5 (4.0, 4.9)	4.5 (4.0, 4.9)	4.2 (3.7, 4.7)	<0.001
PLT, median (IQR), ×10 <sup>9</sup> /L	203.0 (167.0, 248.0)	204.0 (168.0, 248.0)	195.5 (145.5, 254.8)	0.135
ALT, median (IQR), U/L	31.0 (21.0, 48.0)	30.5 (20.0, 46.0)	43.5 (24.0, 82.0)	<0.001
AST, n (%)				<0.001
<500 U/L	2217 (97)	2073 (98)	144 (85)	
500–1000 U/L	45 (2)	32 (2)	13 (8)	
≥1000 U/L	20 (1)	7 (0)	13 (8)	
GGT, median (IQR), IU/L	34.0 (22.0, 58.0)	34.0 (22.0, 56.0)	44.5 (23.0, 78.2)	0.001
CK, median (IQR),U/L	480.0 (174.0, 1335.5)	470.0 (172.0, 1331.0)	562.0 (259.0, 1350.0)	0.065
CKMB, median (IQR),U/L	51.5 (24.0, 124.0)	51.0 (24.0, 124.0)	65.0 (29.0, 138.0)	0.036
LDH, median (IQR),U/L	373.0 (264.2, 596.8)	363.0 (260.0, 572.0)	555.0 (365.8, 907.0)	<0.001
HBDH, median (IQR),U/L	263.0 (173.0, 461.0)	254.5 (169.0, 443.0)	416.0 (232.8, 674.8)	<0.001
CTnT, median (IQR), ng/L	796.1 (203.2, 2563.0)	753.5 (193.0, 2424.5)	2076.5 (595.8, 4178.5)	<0.001
BNP, median (IQR), pg/mL	883.7 (227.2, 2632.0)	812.5 (201.7, 2335.5)	4332.0 (1082.5, 12196.0)	<0.001
<b>Risk assessment</b>				
GRACE score, median (IQR)	122 (102.0, 142.0)	119.0 (102.0, 139.0)	160.0 (128.0, 193.8)	<0.001
Simple-ORBI, median (IQR)	4.0 (2.0, 7.0)	4.0 (2.0, 6.0)	8.0 (5.0, 12.0)	<0.001

Shock index ratio of HR to SBP; SIRI systemic inflammatory response index; SII systemic inflammatory reaction index; PLR ratio of platelets to lymphocytes, NLR ratio of neutrophils to lymphocytes; MLR ratio of monocytes to lymphocytes; GRACE, Global Registry of Acute Coronary Events score;  $\alpha$ -HBDH,  $\alpha$ -Hydroxybutyrate dehydrogenase; BNP B-type natriuretic peptides; NWD Non-weekday admission; CKD, Chronic kidney disease; SBP, systolic blood pressure; DBP, diastolic blood pressure; WBC, White blood cell; HB, Hemoglobin; RBC, Red blood cell; PLT, Platelet; ALT, alanine aminotransferase; AST Aspartate transaminase; GGT, glutamyl transferase, CK, creatine kinase; CKMB, creatine kinase isoenzymes; LDH, lactate dehydrogenase; CTnT, Cardiac troponin; ORBI, The Brittany Regional Infarction Observatory.

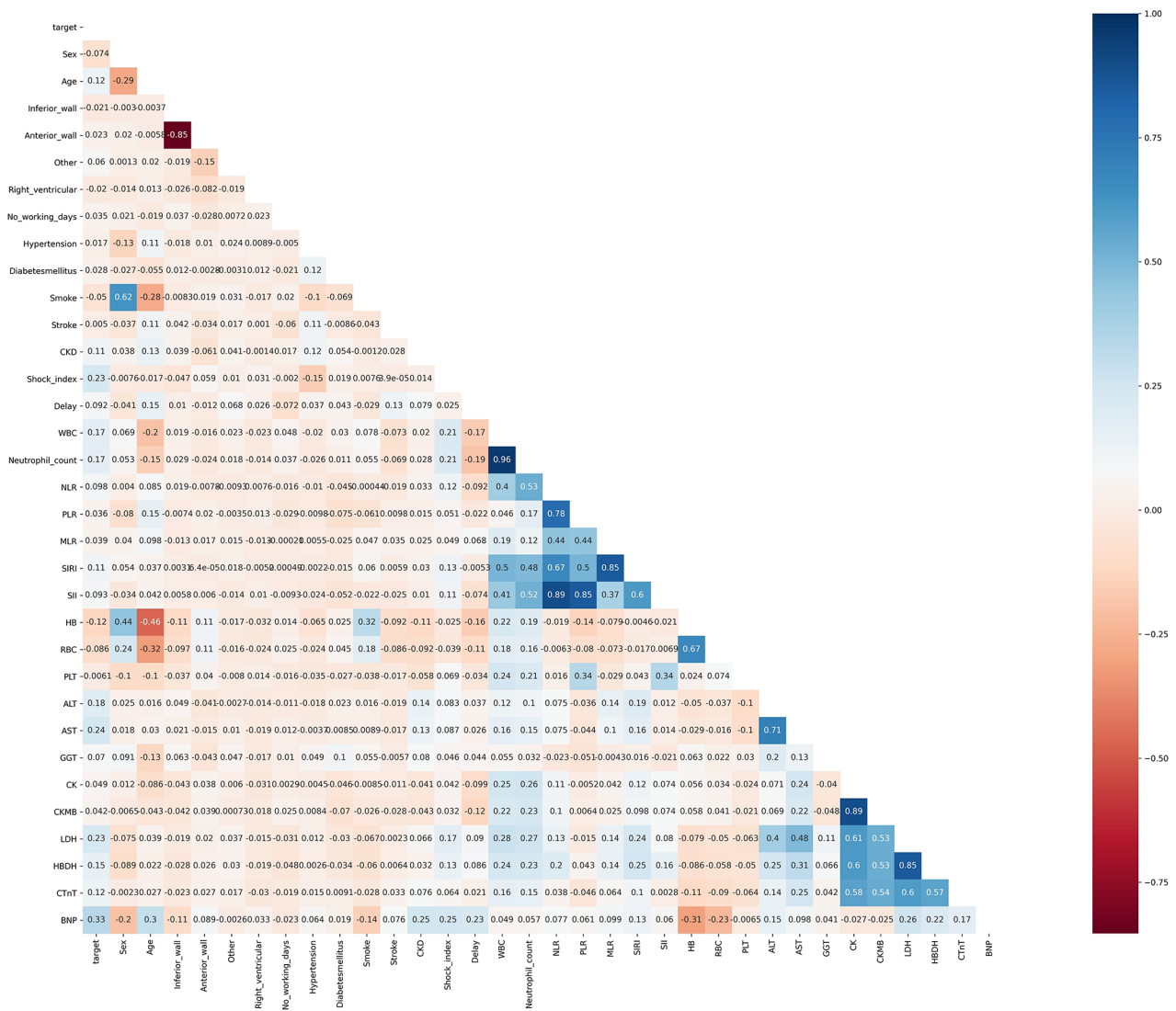
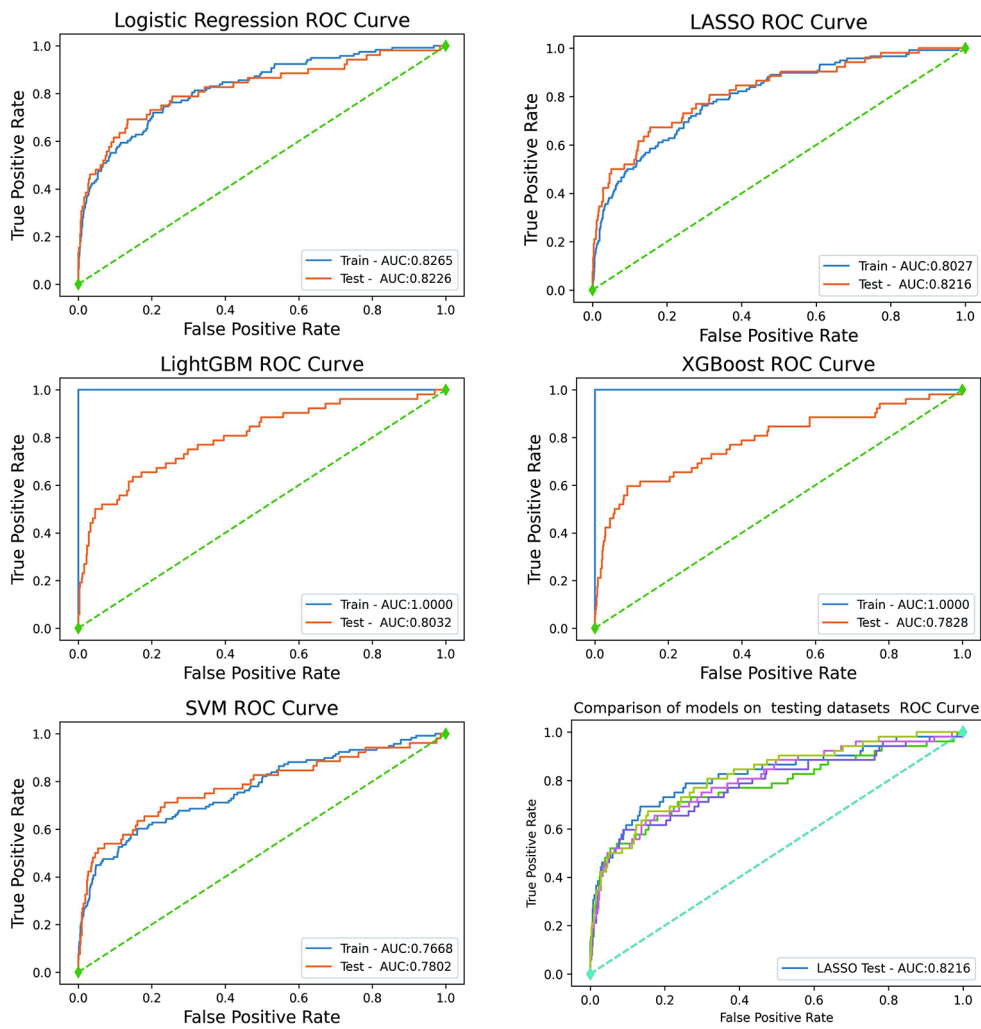


Figure S1 Variable correlation heatmap.



**Figure S2** Receiver operating characteristic (ROC) curves of 5 machine learning model performance with the training dataset and the test dataset.

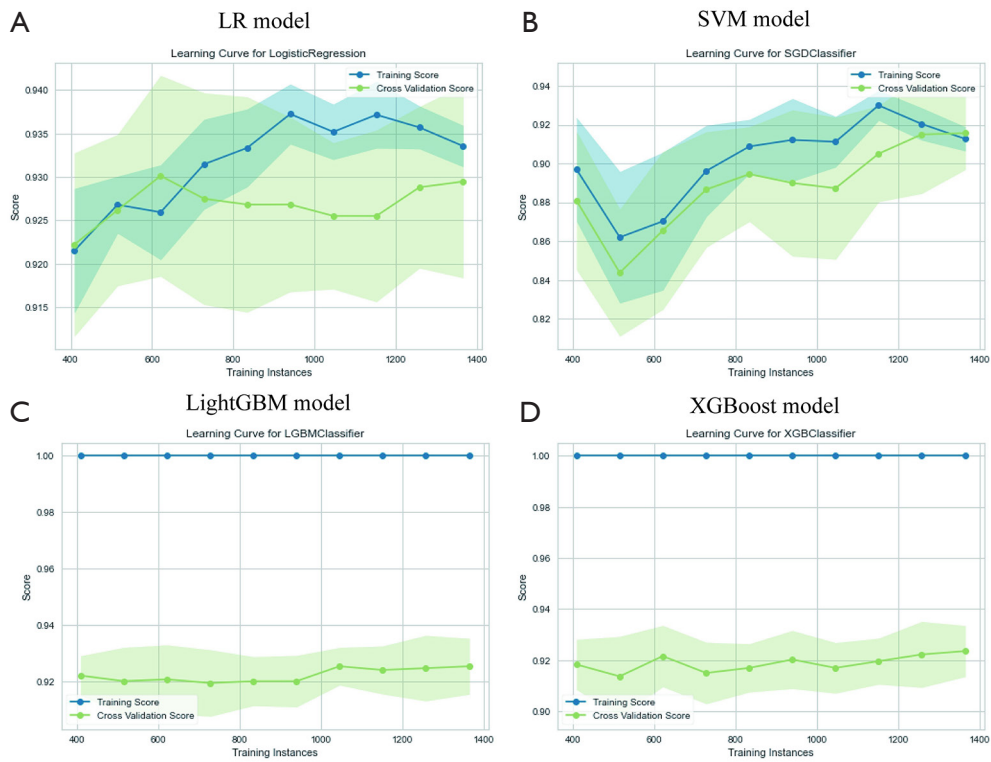


Figure S3 Learning curve for the different models.

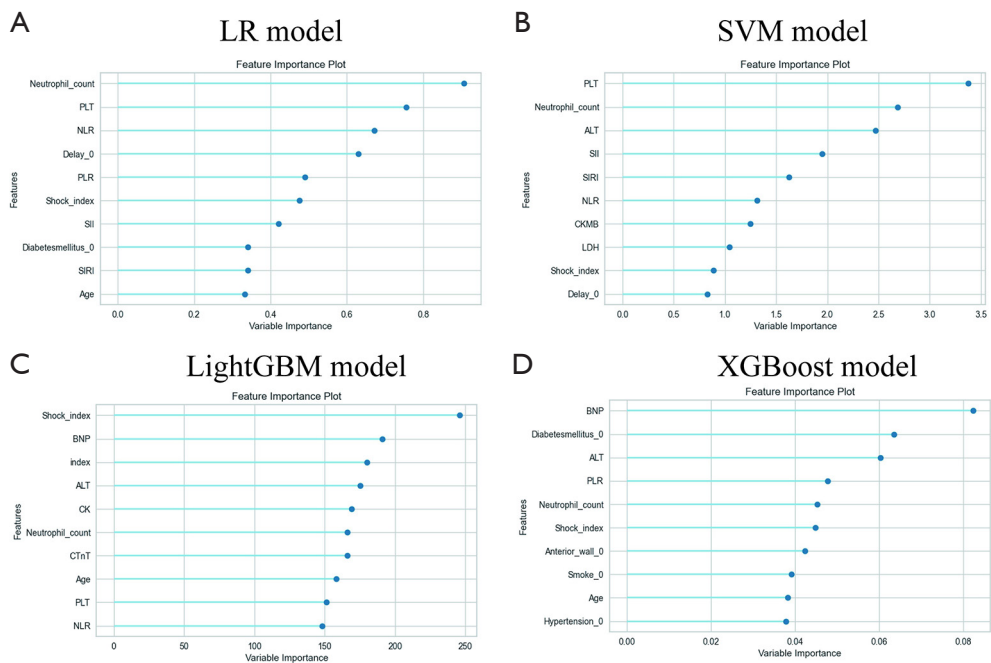
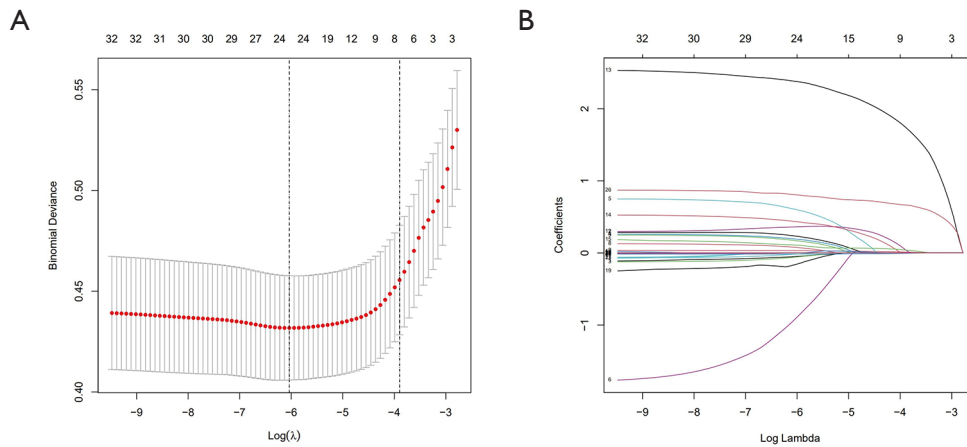


Figure S4 Variable importance size in the different models.



**Figure S5** Selection of demographic and clinical features using the least absolute shrinkage and selection operator (LASSO) binary logistic regression model.

**Table S2** Prediction factors for CS in STEMI patients

Intercept and variable	$\beta$	Prediction model	
		Odds ratio (95% CI)	P-value
(Intercept)	-6.4271	0.0016 (0.0002-0.0115)	P<0.001
Age	0.0345	1.0351 (1.0188-1.0521)	P<0.001
CKD			
No	Reference		
Yes	0.5254	1.6913 (1.0504-2.6568)	0.02606
Delay			
No	Reference		
Yes	0.5191	1.6805 (1.1504-2.4402)	0.00672
Shock index	2.4828	11.9741 (6.0138-23.9791)	P<0.001
WBC	0.1137	1.1203 (1.0769-1.1653)	P<0.001
HB	-0.0166	0.9835 (0.9745-0.9926)	P<0.001
AST			
<500	Reference		
500–1000	0.9568	2.6032 (1.1143-5.8094)	0.02243
>1000	1.5725	4.8185 (1.4578-16.3762)	0.01005
LDH	0.0007	1.0006 (1.0002-1.0011)	0.00463

parameter combinations are exhausted by grid search. Performance evaluation indices such as accuracy, AUC, recall, precision and the Gini coefficient were adopted to assess the average predictive performance of the model. The optimal model was used to develop the late-CS risk nomogram. Shock index ratio of HR to SBP; WBC, white blood cell; HB, hemoglobin; CKD, chronic kidney disease; AST, aspartate transaminase; LDH, lactate dehydrogenase.