Long-term outcomes and predictors of patients with ST elevated versus non-ST elevated myocardial infarctions in non-obstructive coronary arteries: A retrospective study in Northern China

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Abstract

Background. Myocardial infarction with non-obstructive coronary arteries (MINOCA) is a heterogeneous disease entity with diverse etiologies and no uniform treatment protocols. Patients with MINOCA can be clinically classified into two groups based on whether they have an ST-segment elevation (STE) or non-ST segment elevation (NSTE), based on electrocardiogram (ECG) results, whose clinical prognosis is unclear. This study aimed to compare the outcomes and predictors of patients with STE and NSTE in the MINOCA population.

Methods. We collected the data for 196 patients with MINOCA (115 with STE and 81 with NSTE) in China. Clinical characteristics, prognoses, and predictors of major adverse cardiovascular events (MACE) were analyzed during the follow-up of all patients.

Results. The proportion of patients with STE was greater than that with NSTE in the MINOCA population. Patients with NSTE were older and had a higher incidence of hypertension. No differences were observed in the outcomes between the STE and NSTE groups during a median follow-up period of 49(37,46) months. No significant differences were observed in those with MACE (24.35% vs 22.22%, P = 0.73) and those without MACE. The multivariable predictors of MACE in the NSTE groups were Killip grades $\geq$ 2(HR 9.035, CI 95%:1.657-49.263, P=0.011), reduced use of β-blockers during hospitalization (HR 0.238, CI 95%:0.072-0.788, P=0.019), and higher levels of low-density lipoprotein cholesterol (LDL-C) (HR 2.267, CI 95%; 1.008-5.097, P=0.048); the reduced use of β-blockers during hospitalization was the only independent risk factor of MACE in the STE group.

Conclusions. There were differences between the clinical characteristics of patients with STE and NSTE in the MINOCA population, even though outcomes during follow-up were similar. Independent risk factors for major adverse cardiac events were not identical in the STE and NSTE groups, which could be attributable to the differences in disease pathogenesis.

Introduction

48   Myocardial infarction with nonobstructive coronary arteries (MINOCA) is a heterogeneous

49   group of diseases with different pathogeneses. It is characterized by acute myocardial infarction

50   with normal coronary arteries or mild coronary artery stenosis (stenosis < 50%), and occurs

51   commonly in young women (Tamis-Holland et al. 2019). The prevalence of MINOCA

52   reportedly ranges between 1-15% in patients with acute myocardial infarction (AMI), according

53   to different studies (Abdu et al. 2019), and its overall prevalence was 6% in a recent meta-

54   analysis(Pasupathy et al. 2015). MINOCA is a group of syndromes with multiple causes.

55   Individuals with MINOCA can be classified into multiple subgroups, such as those with plaque

56   rupture, coronary dissection, coronary artery spasm, and clinically unrecognized myocarditis or

57   Takotsubo cardiomyopathy; all of these have different underlying pathophysiological

58   mechanisms (Agewall et al. 2017; Niccoli et al. 2015). Therefore, it is potentially challenging to

59   effectively treat MINOCA patients for whom multiple pathogenic mechanisms have various

60   underlying causes. The pathogenesis and prognosis of MINOCA patients need to be assessed

61   further in future studies.

62   Previous studies have reported that patients with MINOCA had lower rates of major adverse

63   cardiovascular events (MACE) and mortality during follow-up than patients with MI-CAD

64   (Montenegro Sá et al. 2018; Pasupathy et al. 2015; Pizzi et al. 2016). Although patients with

65   MINOCA appear to have a slightly better long-term prognosis, compared to MI-CAD(MI with

66   obstructive coronary artery disease) patients, studies conducted in recent years have shown that

67   MINOCA is not always benign   (Barr et al. 2018; Raparelli et al. 2018). Notably, a Swedish

68   study conducted over 4 years has shown that adverse cardiovascular events occurred in 23.9% of

69   MINOCA patients during follow-up; among these, the mortality rate could be as high as 13.4%

70   (Lindahl et al. 2017). Moreover, a Japanese study also showed that MINOCA patients had a

71   higher mortality rate within 30 days of follow-up, as compared to MI-CAD patients (4.48% VS

72   3.46%) (Ishii et al. 2020).

73   However, the differences in clinical features and prognosis between patients with ST-segment

74   elevated myocardial infarction (STEMI) and non-ST segment elevated myocardial infarction

75   (NSTEMI) remain controversial. The occurrence of NSTEMI is more common than STEMI in

76   the MINOCA population (Pasupathy et al. 2015; Xu et al. 2020). Previous studies have reported

77   that STEMI patients had a poorer short-term prognosis and a more favorable long-term

78   prognosis(Borrayo-Sánchez et al. 2018; Polonski et al. 2011). A large-scale Swedish study of

79   MINOCA patients reported that during the 2.6-year follow-up period, the mortality rate for

80   STEMI patients was 8%, while the mortality rate for NSTEMI patients was lower at

81   5%(Nordenskjöld et al. 2018), which was inconsistent with the results reported by Li et al.(Li et

82   al. 2022). Nevertheless, some studies suggest that there were no differences in prognosis between

83   patients with STEMI and NSTEMI(Montalescot et al. 2007).

84   Some studies have shown that the history of atrial fibrillation, Killip grade, age, and treatment

85   strategy were significant independent risk factors for prognosis in MINOCA patients

86   (Montalescot et al. 2007; Polonski et al. 2011), while the predictors of prognosis in STE and

87   NSTE patients are still unclear. Although the differences in prognosis between STEMI and

88   NSTEMI patients in the AMI population have been reported hitherto, the differences in

89   prognosis and predictors of prognosis among MINOCA patients with STE and NSTE remain

90   unclear. This study aimed to compare the clinical features, prognosis, and predictors of MACE

91   during the follow-up period among MINOCA patients with STE and NSTE in Northern China.

92

Materials & Methods

Patients

95   We conducted a retrospective study of patients who had been admitted to the First Hospital at

96   Jilin University due to AMI from January 2015 to July 2018 and had undergone coronary

97   angiography during hospitalization. Patients were included in the study if: (1) they met the

98   diagnostic criteria specified in the AMI guidelines (Thygesen et al. 2018); (2) no occlusion of

99   any infarct-related coronary artery and <50% stenosis could be observed in all epicardial vessels;

100   (3) the patient received no other alternative diagnosis during clinical presentation (e.g., non-

101   ischemic causes such as sepsis, acute renal failure, pulmonary embolism, and myocarditis); and

102   (4) age >18 years. Patients were excluded if: (1) thrombolytic therapy had been performed prior

103   to coronary angiography; (2) they had a previous myocardial infarction or coronary

104   revascularization; (3) previously underwent cardiac surgery; (4) had malignant tumors.

105   This study has been conducted in accordance with the Declaration of Helsinki and was approved

106   by the Ethical Review Board of the hospital (the First Hospital of Jilin University, Changchun,

107   China). Patient informed consent was waived, as this study was retrospective.

108

109   **Data collection**

110   Most of the data were obtained from the medical records at the First Hospital of Jilin University

111   that contained data on the baseline characteristics, biochemical markers, electrocardiogram

112   (ECG) images, coronary angiography, and medications provided during hospitalization. Basic

113   patient information (e.g., age, sex) and past medical history (e.g., smoking history, history of

114   hypertension, hyperlipidemia, diabetes, arrhythmias) were recorded in detail. The history of

115   arrhythmias including previous atrial arrhythmias or ventricular arrhythmias or heart block. We

116   collected information regarding biochemical markers, including blood cardiac troponin-T(cTnT),

117   creatine kinase-MB(CK-MB), brain natriuretic peptide (BNP), total cholesterol (TC), low-

118   density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C),

119   triglyceride (TG) and indicators of echocardiography, including LV (left ventricle) and LVEF

120   (left ventricular ejection fraction) in 24 hours after hospitalization. We classified the patients into

121   the STE and NSTE groups based on their ECG results. STE and NSTE were defined in

122   accordance with the Fourth Universal Definition of Myocardial Infarction (Thygesen et al.

123   2018).

124   The primary clinical endpoint of our study was the occurrence of major adverse cardiovascular

125   events (MACE), including rehospitalization for increased chest pain that did not meet the criteria

126   of AMI, based on ECG results and myocardial injury marker levels, and occurrence of non-fatal

127   MI, heart failure, stroke, heart valve replacement, and all-cause deaths, which included

128   cardiovascular and non-cardiovascular deaths. A diagnosis of MI was made if patients exhibited

129   the dynamic development of cardiac troponin in conjunction with symptoms suggestive of

130   myocardial ischemia. Cardiovascular death was defined as death because of acute coronary

131   syndrome(ACS), cardiac rupture, severe arrhythmias, or refractory severe heart failure. A stroke

132   was defined as an ischemic cerebral infarction caused by thrombotic or embolic occlusions in

133   any major intracranial artery. A diagnosis of heart failure (HF) was established according to the

134   current guidelines of the European Society of Cardiology(ESC) (Ponikowski et al. 2016).

135

136   **Statistical analysis**

137   Statistical analysis was performed using SPSS 25.0 software. Normally distributed continuous

138   variables were presented as mean ± standard deviation (SD) values. Non-normally distributed

139   continuous variables were presented in terms of the median and inter-quartile range (IQR).

140   Categorical variables were presented as counts and percentages. An independent sample t-test

141   and the Mann-Whitney U test were used to perform a comparison of continuous variables

142   between groups. Categorical variables were compared using the Chi-square and Fisher's exact

143   tests. We used logistic regression analysis to evaluate the independent risk factors of outcomes in

144   the STE and NSTE groups, while the adjusted OR for MACE was calculated via logistic

145   regression analysis. All the tests performed were two-sided tests and values were identified to be

146   statistically significant at a P-value < 0.05.

147

148   # Results

149   **Baseline characteristics of patients**

150   In our study, the median follow-up period was 49(37,46)months. A total of 9696 patients

151   were diagnosed with MI; among these, 196 patients (2.02%) satisfied the diagnostic criteria for

152   MINOCA. Based on the ECG results, 115 patients (58.7%) were included in the STE group,

153   while 81 patients (41.3%) were included in the NSTE group (Figure 1). A comparison of the

154   baseline characteristics between patients with STE and NST among the MINOCA population has

155   been shown in Table 1.

156 In comparison to NSTE patients, patients with STE were younger. Patients with NSTE had a

157 higher incidence of hypertension, whereas no significant differences were observed in the

158 incidence of other coronary risk factors (e.g., diabetes, hyperlipidemia, previous arrhythmia,

159 smoking history). The medications administered at discharge have been shown in Table 1. There

160 were no significant differences between the two groups except for the fact that the more frequent

161 use of aspirin and lower use of ACEI/ARB at admission in the STE group. Thus, the proportions

162 of patients using clopidogrel, β-blockers, and statins were similar in the two groups. The level of

163 serum glucose on admission in the NSTE group was higher than that in the STE group, while the

164 other laboratory parameters were not significantly different among the two groups.

165

166 **Follow-up**

167 During a median follow-up period of 49 months (interquartile range [IQR] 37-61), MACE

168 occurred in 46 (23.47%) out of a total of 51 patients. In the STE and NSTE groups, we observed

169 the occurrence of MACE in 28 (24.35%) and 18 (22.22%) patients, respectively. The data are

170 shown in Table 2. Thirty-one cases of MACE were observed in 28 patients (24.35%) in the

171 STEMI group, including in patients who had to undergo rehospitalization for chest pain (4

172 cases,3.48%), non-fatal MI (3 cases,2.61%), heart failure (14 cases,12.17%), stroke (5

173 cases,4.35%), and all-cause deaths (5 cases,4.35%). In the NSTEMI group, 20 cases MACE

174 (24.35%) were observed in 18 patients (22.22%); these included chest pain (4 patients, 4.49%,

175 non-fatal MI (2 patients, 2.47%), heart failure (8 patients, 9.88%), stroke (3 patients, 3.70%),

176 heart valve replacement (2 patients, 2.47%), and all-cause death (1 patient,1.23%).

177 There were no statistical differences in the prevalence of MACE between the NSTE and STE

178 groups (P=0.73). In this study, 5 patients died of cardiogenic diseases. During the follow-up

179 period, there was no significant difference in the incidence of chest pain, non-fatal MI, heart

180 failure, stroke, heart valve replacement, and all-cause death between the STE and NSTE groups

181 among the MINOCA population (P>0.05).

182

183 **Predictive factors**

184 Univariate analysis showed that older age, Killip grade ≥2, longer hospitalization duration, being

185 born male, lower use of β-blockers during hospitalization, and red blood cell counts were

186 significant risk factors for MACE in the STE group (Table 3).

187 We conducted a multivariate analysis adjusted for age, Killip grades, hospitalization duration,

188 sex, use of β-blockers during hospitalization, red blood cell counts, history of diabetes, and level

189 of low-density lipoprotein cholesterol (LDL-C). The results showed that Killip grades ≥ 2(HR

190 9.035, Cl 95%:1.657-49.263, P=0.011), lowered use of β-blockers during hospitalization(HR

191 0.238, Cl 95%:0.072-0.788, P=0.019) and higher LDL-C levels (HR 2.267, Cl 95%: 1.008-5.097,

192 P=0.048)were independent risk factors for MACE in patients with STE (Table 4).

193 Univariate analysis showed that older age and lowered use of β-blockers during hospitalization

194 were associated with a higher extent of occurrence of MACE in the NSTE group (Table 3).

195 The age and extent of use of β-blockers and aspirin during hospitalization were adjusted via

196 multivariate analysis. The results revealed that the lowered use of β-blockers during

197 hospitalization was the only independent risk factor for MACE in patients with NSTE (HR

198 0.303, Cl 95%: 0.093-0.991, P=0.048). Thus, the use of β-blockers could improve the prognosis

199 of MINOCA patients with NSTE.

200

201 **Discussion**

202 The objective of this study was to compare the prognosis and predictors of MACE among

203 MINOCA patients with STE and NSTE. Our major findings were as follows: (1) There were

204 differences in clinical features between the STE and NSTE groups among MINOCA patients; (2)

205 there was no statistical difference in the incidence of MACE between the STE and NSTE groups

206 during follow-up; (3) the independent risk predictors of MACE in MINOCA patients with STE

207 include a higher level of LDL-C, Killip grades≥2, and lowered use of β-blockers during

208 hospitalization, whereas the lowered use of β-blockers during hospitalization was the only

209 multivariable predictor of MACE in MINOCA patients with NSTE.

210   MINOCA has always been a confusing clinical entity that is characterized by myocardial

211   infarctions with normal or near-normal coronary arteries of angiography (Scalone et al. 2019).

212   Due to the difference in sample size and definition among various cohorts, the incidence of

213   MINOCA in patients with acute myocardial infarction (AMI) is 1-15% (Kilic et al. 2020;

214   Nordenskjöld et al. 2018; Xu et al. 2020), which is consistent with the findings of our study.

215   Although the underlying causes of MINOCA are diverse, patients can be classified into the

216   STEMI and NSTEMI groups based on their electrocardiogram (ECG) results. Among MINOCA

217   patients, the proportion of patients with NSTEMI is higher than that of those with STEMI

218   (Pasupathy et al. 2015; Xu et al. 2020), which was in contrast to the findings of our study. This

219   result may be attributable to the fact that our study is a single-center study with a small sample

220   size. Certain previous studies have reported that there were significant differences in the clinical

221   features of MINOCA patients with STEMI and NSTEMI (Borrayo-Sánchez et al. 2018; Hanssen

222   et al. 2012). Recently, a Chinese study on MINOCA reported that patients with NSTE were

223   older, mostly female, and had a higher incidence of atrial fibrillation. Furthermore, patients with

224   STE were more likely to have a history of smoking and a higher diastolic blood pressure,

225   whereas there were no significant differences in the incidence of other risk factors for coronary

226   problems (e.g., hypertension, diabetes) between the two groups (Xu et al. 2020). Our study found

227   that patients with NSTEMI had a higher age and a higher proportion of the patients had

228   hypertensive disease, compared to STEMI patients, which was consistent with the findings of the

229   study by Johnston et al. (Johnston et al. 2015). Therefore, these differences may be associated

230   with the different pathogeneses of the two groups; this needs to be confirmed in multi-center and

231   prospective studies with a large sample size.

232   The prognostic differences between STEMI and NSTEMI patients in the MINOCA population

233   remain controversial. Previous studies have reported higher short-term mortality in STEMI

234   patients and higher long-term mortality in NSTEMI patients (Borrayo-Sánchez et al. 2018;

235   Johnston et al. 2015; Park et al. 2013), which was also observed in the MINOCA population

236   (Nordenskjöld et al. 2018). Johnston et al. reported that all-cause mortality was significantly

237 higher in MINOCA patients with STEMI than in NSTEMI patients and that their long-term

238 prognosis was poorer (Johnston et al. 2015). A recent study demonstrated that the mortality of

239 patients with MINOCA presenting with STEMI was relatively high at 4.5% at year 1 (Gue et al.

240 2019). This might be related to the occurrence of congestive heart failure because of highly

241 extensive and severe myocardial damage. However, no statistically significant differences in

242 mortality were observed between STEMI and NSTEMI patients in this study. Our findings were

243 similar to those of Xu (Xu et al. 2020) because we found that there was no statistical difference

244 in the incidence of MACE (rehospitalization for chest pain, non-fatal MI, heart failure, stroke,

245 heart valve replacement and all-cause death, etc.) in the follow-up period between the STEMI

246 and NSTEMI groups, which may be related to the similar drug therapies administered to patients

247 from different sub-groups.

248 There are several inconsistencies regarding the predictors of MACE in STEMI and NSTEMI

249 patients in previous studies. One study reported that STEMI and NSTEMI patients differed

250 significantly with regard to predictors of early and late-term mortality (Park et al. 2013; Polonski

251 et al. 2011). In addition, the study conducted by Xu demonstrated that the predictors of MACE in

252 MINOCA patients with STE and NSTE were different; the independent predictors of MACE in

253 the NSTEMI group were age, lower level of TC, hypertension, and smoking history, and the

254 strongest predictors in the STEMI group were reduced LVEF levels and a history of diabetes

255 mellitus (Xu et al. 2020). A large meta-analysis showed that a further reduction in LDL-C levels

256 was effective in reducing the incidence of prognostic cardiovascular disease and stroke (Baigent

257 et al. 2010), which was consistent with our findings, which showed that a higher LDL-C level

258 was an independent risk factor for MACE in the STEMI group. The use of statins in patients

259 with MINOCA for reducing the LDL-C levels and stabilizing and controlling coronary plaque

260 progression has had a beneficial prognostic impact (Choo et al. 2019). Johnston et al. found that

261 among STEMI patients, the all-cause mortality was significantly higher in females than in males

262 (Johnston et al. 2015), while this difference in mortality between the sexes was not observed in

263   our research. We suggest that this complexity is reflective of the heterogeneous features of

264   MINOCA in terms of STE and NSTE.

265   Currently, there is no uniform treatment for the MINOCA population. We found that β-blocker

266   medication was a protective factor for MACE during the follow-up period in the MINOCA

267   population with NSTEMI and STEMI, which is consistent with the findings of Ciliberti et

268   al.(Ciliberti et al. 2021). However, the findings of the study by Adbu showed that the treatment

269   of MINOCA with statins and ACEI/ARB had long-term beneficial effects on the outcome,

270   whereas β-blocker and DAPT treatment seemed to have no significant effect on the occurrence

271   of MINOCA(Abdu et al. 2019). The administration of characteristic therapies is necessary for

272   patients in whom the occurrence of MINOCA is attributable to different underlying mechanisms.

273   All the above-mentioned studies suggest that the use of secondary preventative medications for

274   cardiovascular disease may significantly improve the prognosis of the MINOCA population and

275   should be advocated, but this needs to be confirmed in multicenter studies with longer follow-up

276   periods.

277

278   **Limitations**

279   There are several limitations to our study. One of the major limitations is that our study was a

280   single-center retrospective study with a small sample size and a short follow-up period, because

281   of which our findings might lead to biased findings. Second, cardiac magnetic resonance (CMR)

282   cloud not be performed for all patients due to medical insurance-related issues and the lack of

283   CMR may influence the accuracy of our findings in MINOCA patients. Finally, information

284   regarding medications to be administered in the follow-up period could not be obtained for all

285   patients. Hence, we could not further analyze whether the long-term use of secondary

286   preventative medications was beneficial for patients with MINOCA. A larger multi-center

287   randomized controlled study is necessary to clarify the results of this study.

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289

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Conclusions

292 In conclusion, the clinical characteristics of the STE and NSTE groups differed in patients with

293 MINOCA, whereas the outcomes during the 49-month follow-up were similar. The predictors for

294 MACE in patients between the STE group and NSTE group were not thoroughly identical.

295

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297

Competing Interests

299 The authors declare there are no competing interests.

300 Human Ethics

301 We declare that this study has been approved by the Ethics Committee of the First Hospital of Jilin

302 University.

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419   Figure legends

420 Fig. 1 Flow chart of patients included in this study.

421 Abbreviations: AMI, acute myocardial infarction, CAG, coronary angiography, STE, ST-

422 segment elevation, NSTE, non-ST segment elevation, MINOCA, non-obstructive coronary

423 arteries

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425

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Figure 1

Flow chart of patients included in this study

Flow chart of cases collection in this study.
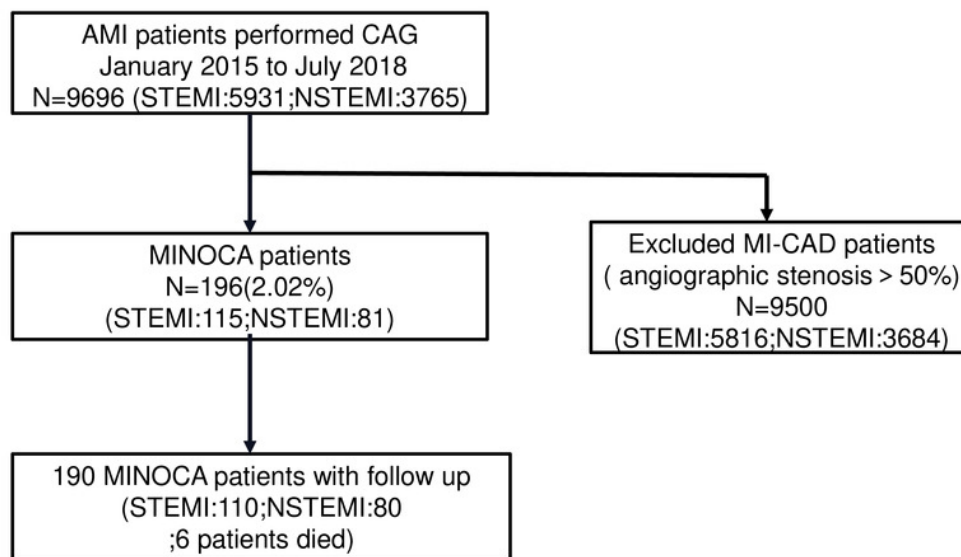
Table 1 Comparision of the baseline characteristics between STEMI and NSTEM among MINOCA population

2 Table 1 Comparision of the baseline characteristics between STEMI and NSTEM among MINOCA population

Variables	STEMI(n=115)	NSTEMI(n=81)	P
Demographics			
Age(years)	52.93±12.68	56.47±11.21	0.045
Male,n(%)	81(70.43)	60(74.07)	0.577
Coronary risk factors			
Diabetes, n (%)	11(9.57)	12(14.81)	0.261
Hypertension, n (%)	47(40.87)	48(59.26)	0.011
hyperlipidaemia, n (%)	33(28.70)	23(28.39)	0.927
previous arrhythmia, n (%)	9(7.83)	7(8.64)	0.837
Smoking history, n (%)	83(72.13)	52(64.20)	0.235
Killip grade, n (%)			
1 grade	103(89.57)	64(79.01)	0.040
≥2 grades	12(10.43)	17(20.99)	
hospitalization days(days)	6(4,8)	7(4,8)	0.305
Medications during hospitalization			
Aspirin, n (%)	112(97.39)	73(90.12)	0.018
Clopidogrel, n (%)	108(93.91)	73(90.12)	0.415
β-blocker, n (%)	51(44.35)	41(50.62)	0.468
Statins, n (%)	110(95.65)	77(95.06)	0.721
ACEI/ARB(%)	44(38.26)	45(55.56)	0.017
Laboratory indicators			
Myoglobin (ng/ml)	94(46.8,309.00)	101.5(53.08,178.75)	0.917
cTnT((ng/ml))	3.02(0.18,13.5)	1.34(0.22,5.87)	0.076
CK-MB	5.95(1.08,33,45)	3.80(1.00,12.81)	0.102
BNP	112(27.13,297.75)	61.90(20.40,186.00)	0.106
WBC count(×10^12/L)	8.24(6.24,10.38)	7.52(6.01,9.28)	0.158
NE(%)	5.24(3.94, 8.04)	4.99(3.71,6.55)	0,231
RBC count(×10^12/L)	4.61(4.27,4.97)	4.69(4.45,4.94)	0.457

PLT count(×10^12/L)	221.5(182.00,266.75)	210(172.25,255.75)	0.262
TC (mmol/L)	4.20(3.67,4.95)	4.51(3.75, 5.25)	0.115
LDL-C (mmol/L	2.44(1.99,1.45)	2.45(2.09,3.35)	0.109
HDL-C (mmol/L)	1.18(0.99,1.45)	1.2(1.05,1.48)	0.305
TG (mmol/L	1.45(1.06,2.37)	1.51(1.11,2.21)	0.718
Serum glucose(mmol/L)	5.19(4.66,5.95)	5.55(4.87,6.44)	0.047
Echocardiography			
LV(mm)	49(46, 52)	50(46.75,52)	0.333
LVEF(%)	57(54,60)	59(55, 60)	0.128

3 Abbreviation:cTnT,blood cardiac troponin-T,CK-MB,creatine kinase-MB,BNP,brain natriuretic

4 peptide,RBC,Red blood cell,WBC,White blood cell,NE,

5 neutrophilicgranulocyte,PLT,Platelet,TC,total cholesterol,LDL-C,low-density lipoprotein

6 cholesterol,HDL-C,high-density lipoprotein cholesterol,TG,triglyceride, LV, left

7 ventricle,LVEF,left ventricular ejection fraction .

Table 2 Comparision of the rate of MACE in MINOCA during follow-up period.

2 Table 2 Comparision of the rate of MACE in MINOCA during follow-up period.

	STEMI(n=115)	NSTEMI(n=81)	P
MACE,n(%)	28(24.35)	18(22.22)	0.73
Chest pain rehospitalization, n (%)	4(3.48)	4(4.94)	0.72
nonfatal MI, n (%)	3(2.61)	2(2.47)	1
Heart failure, n (%)	14(12.17)	8(9.88)	0.654
Stroke, n (%)	5(4.35)	3(3.70)	1
Heart valve replacement, n (%)	-	2(2.47)	0.17
All-cause deaths, n (%)	5(4.35)	1(1.23)	0.404

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Table 3 Univariate analysis of MACE among STEMI and NSTEMI population

2 Table 3 Univariate analysis of MACE among STEMI and NSTEMI population

Factors	MACE$_{STE}$(n=28)	P$_{STE}$	MACE$_{NSTE}$(n=18)	P$_{NSTE}$
Age(years)	57.39±13.74	0.003	60.44±9.94	0.049
Male,n(%)	15 (53.57)	0.025	15 (83.33)	0.376
Diabetes, n (%)	5 (17.86)	0.086	5 (27.78)	0.126
Hypertension, n (%)	14 (50.00)	0.259	13 (72.22)	0.204
hyperlipidaemia, n (%)	6 (21.43)	0.266	3 (16.67)	0.245
previous arrhythmia, n (%)	2 (7.14)	1.000	3 (16.67)	0.339
Smoking history, n (%)	19 (67.85)	0.558	11 (61.11)	0.757
Killip grade, n (%)				0.145
1 grade	20 (71.43)	0.001	12 (66.67)	
≥2 grades	8 (28.57)		6 (33.33)	
Laboratory indicators				
Myoglobin (ng/ml)	97.25 (50.20,248.25)	0.539	105.00 (53.63,173.25)	0.934
cTnT(ng/ml)	2.65 (0.07,14.57)	0.661	0.54 (0.19,8.99)	0.578
CK-MB(ng/ml)	4.17 (1.00,25.55)	0.481	3.79 (1.00,15.12)	0.986
BNP	120.00 (32.60,848.00)	0.305	85.45 (31.55,249.45)	0.150
WBC count(×10^12/L)	8.20 (5.97,11.65)	0.931	7.52 (5.59,8.79)	0.461
RBC count(×10^{12}/L)	4.43 (4.15,4.66)	0.016	4.68 (4.43,4.93)	0.773
PLT count(×10^{12}/L)	219.00 (186.00,255.00)	0.401	198.50 (154.75,250.50)	0.450
TC (mmol/L)	4.11 (3.35,4.94)	0.276	4.68 (3.52,5.37)	0.775
LDL-C (mmol/L)	2.32 (1.77,2.80)	0.085	2.63 (1.98,3.20)	0.579
HDL-C (mmol/L)	1.21 (1.02,1.60)	0.372	1.31 (1.17,1.59)	0.113
TG (mmol/L	1.33 (0.90,1.73)	0.170	1.36 (0.95,2.00)	0.229
Serum glucose(mmol/L)	5.46 (4.73,6.72)	0.262	5.62 (4.84,6.74)	0.775
Echocardiography				
LV (mm)	49.00 (46.00,52.00)	0.989	50.50 (47.75,55.00)	0.191
LVEF (%)	58.00 (51.00,60.00)	0.949	58.00 (50.75,60.50)	0.330

hospitalization days(days)	7.00 (5.00,8.00)	0.037	6.50 (3.75,9.00)	0.991
Medications during hospitalization				
Aspirin, n (%)	28 (100.00)	1.000	14 (77.78)	0.086
Clopidogrel, n (%)	26 (92.86)	0.634	17 (94.45)	0.677
β-blocker, n (%)	8 (28.57)	0.048	5 (27.78)	0.028
Statins, n (%)	28 (100.00)	0.571	17 (94.45)	1.000
ACEI/ARB(%)	25 (89.28)	0.754	16(88.89)	0.534

3 Abbreviation: cTnT, blood cardiac troponin-T, CK-MB, creatine kinase-MB, BNP, brain

4 natriuretic peptide, RBC, Red blood cell, WBC, White blood cell, PLT, Platelet, TC, total

5 cholesterol, LDL-C, low-density lipoprotein cholesterol, HDL-C, high-density lipoprotein

6 cholesterol, TG, triglyceride, LV, left ventricle, LVEF, left ventricular ejection fraction.

Table 4 Multivariable predictors of MACE in STEMI patients.

3 Table 4 Multivariable predictors of MACE in STEMI patients.

Factors	OR	95%Cl	P
Killip grade	9.035	(1.657,49.263)	*0.011*
β-blocker	0.238	(0.072,0.788)	0.019
LDL-C	2.267	(1.008,5.097)	0.048

4 Abbreviation:LDL-C,low-density lipoprotein cholesterol.