**Supplementary Materials**

# Long-term prognosis of fulminant myocarditis: a multicenter prospective cohort study in China

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**Table S1. Clinical characteristics of patients with cardiovascular death or heart transplantation**

| Patient | Age, y | Sex | Type of myocarditis | MCS | CRRT | IG | GC | Outcome (causes) | Time-to-event, months |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 61 | Male | FM | IABP | Yes | Yes | Yes | Death (cardiac arrest) | 24 |
| 2 | 33 | Female | FM | IABP | No | Yes | Yes | Heart transplantation (CHF) | 60 |
| 3 | 30 | Female | NFM | No | No | Yes | Yes | Heart transplantation (DCM) | 42 |
| 4 | 43 | Female | FM | IABP | No | Yes | Yes | Death (cardiac arrest) | 3 |
| 5 | 35 | Female | FM | IABP+ECMO | No | Yes | Yes | Death (cardiac rapture) | 1 |
| 6 | 14 | Female | FM | IABP+ECMO | Yes | Yes | Yes | Heart transplantation (CHF) | 18 |
| 7 | 56 | Male | FM | IABP | Yes | Yes | Yes | Death (cardiac arrest) | 3 |
| 8 | 58 | Female | FM | IABP+ECMO | No | Yes | Yes | Death (cardiac arrest) | 3 |

MCS, mechanical circulation support; FM, fulminant myocarditis; NFM, non-fulminant myocarditis; IABP, intra-aortic ballon pump; ECMO, extracorporeal membrane oxygenation; CRRT, continuous renal replacement therapy; IG, immunoglobulin; GC, glucocorticoids; CHF, chronic heart failure; DCM, dilated cardiomyopathy

**Table S2. Clinical characteristics of adult patients (≥15 years) admitted with proven FM and NFM**

| Characteristics | FM (173) | NFM (160) | *P* |
|---|---|---|---|
| Female | 90 (52.0) | 40 (25.0) | <0.001 |
| Age | 34.00 [23.00, 51.00] | 26.00 [18.00, 38.50] | <0.001 |
| TFOHA | 3.00 [2.00, 5.00] | 3.00 [2.00, 4.25] | 0.017 |
| LOS | 12.00 [9.00, 16.00] | 7.00 [5.00, 9.00] | <0.001 |
| Smoking status | | | 0.493 |
| Never | 140 (80.9) | 135 (84.4) | |
| Former or Current | 33 (19.1) | 25 (15.6) | |
| Drinking status | | | 0.542 |
| Never | 160 (92.5) | 144 (90.0) | |
| Former or Current | 13 (7.5) | 16 (10.0) | |
| ECG at admission | | | |
| ST-T segment abnormalities | 119 (68.8) | 63 (39.4) | <0.001 |
| Advanced AV block | 31 (17.9) | 2 (1.2) | <0.001 |
| VT/VF | 18 (10.4) | 0 (0.0) | <0.001 |
| Cardiac arrest | 17 (9.8) | 0 (0.0) | <0.001 |
| Echocardiography at admission | | | |
| LVEF | 30.00 [25.00, 45.00] | 57.00 [50.00, 61.00] | <0.001 |
| Admission laboratory tests | | | |
| cTnI | 19249.20 [3875.20, 42185.00] | 2996.50 [506.30, 8723.17] | <0.001 |
| NT-proBNP | 5483.00 [2029.00, 10620.00] | 502.00 [193.00, 1476.50] | <0.001 |
| ALT | 5483.00 [2029.00, 10620.00] | 502.00 [193.00, 1476.50] | <0.001 |
| AST | 136.00 [69.00, 286.00] | 49.00 [30.00, 88.50] | <0.001 |
| Scr | 77.00 [61.00, 103.00] | 73.00 [62.75, 87.00] | 0.209 |
| Serum potassium | 4.17 [3.78, 4.55] | 3.95 [3.70, 4.25] | <0.001 |
| LDH | 487.00 [318.00, 754.00] | 257.00 [182.50, 338.25] | <0.001 |
| CRP | 27.30 [8.00, 75.00] | 14.80 [4.15, 59.00] | 0.020 |
| ESR | 10.00 [5.00, 20.00] | 8.00 [5.00, 16.25] | 0.199 |
| CMR performed | 153 (88.4) | 139 (86.9) | 0.789 |
| EMB performed | 66 (38.2) | 42 (26.2) | 0.028 |
| Primary outcome | 86 (49.7) | 63 (39.4) | 0.074 |
| Time to event | 18.00 [6.00, 42.00] | 30.00 [6.00, 54.00] | 0.018 |
| Secondary outcome | 70 (40.5) | 23 (14.4) | <0.001 |

Values are median (interquartile range) or n (%). FM, fulminant myocarditis; NFM, non-fulminant myocarditis; TFOHA, time from onset to hospital admission; LOS, length of stay; AV, atrioventricular; VT, ventricular tachycardia; VF, ventricular

fibrillation; LVEF, left ventricular ejection fraction; cTnI, cardiac troponin I; NT-proBNP, N-terminal pro-B-type natriuretic peptide; ALT, alanine aminotransferase; AST, aspartate aminotransferase; Scr, serum creatinine; LDH, lactate dehydrogenase; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate.

**Table S3. In-hospital treatment of adult patients (≥15 years) admitted with proven FM and NFM**

| Characteristics | FM (173) | NFM (160) | *P* |
|---|---|---|---|
| Temporary MCS devices | | | |
| IABP | 161 (93.1) | 0 (0.0) | <0.001 |
| Days | 5.00 [3.00, 7.00] | 0.00 [0.00, 0.00] | <0.001 |
| ECMO | 52 (30.1) | 0 (0.0) | <0.001 |
| Days | 0.00 [0.00, 3.00] | 0.00 [0.00, 0.00] | <0.001 |
| Pacemaker | 58 (33.5) | 0 (0.0) | <0.001 |
| Days | 0.00 [0.00, 4.00] | 0.00 [0.00, 0.00] | <0.001 |
| Other support devices | | | |
| CRRT | 42 (24.3) | 1 (0.6) | <0.001 |
| Hours | 0.00 [0.00, 0.00] | 0.00 [0.00, 0.00] | <0.001 |
| CPR/Defibrillation | 25 (14.5) | 0 (0.0) | <0.001 |
| Immunoregulatory therapy | | | |
| Immunoglobulin | 170 (98.3) | 107 (66.9) | <0.001 |
| Glucocorticoids | 173 (100.0) | 139 (86.9) | 0.004 |
| Other drugs therapy | | | |
| Inotropes | 93 (53.8) | 0 (0.0) | <0.001 |
| Antiviral drugs | 167 (96.5) | 138 (86.2) | 0.001 |
| ACEI/ARB | 111 (64.2) | 77 (48.1) | 0.005 |
| Beta blockers | 103 (59.5) | 84 (52.5) | 0.237 |

Values are median (interquartile range) or n (%). FM, fulminant myocarditis; NFM, non-fulminant myocarditis; MCS, mechanical circulation support; IABP, intra-aortic ballon pump; ECMO, extracorporeal membrane oxygenation; CRRT, continuous renal replacement therapy; CPR, cardiopulmonary resuscitation; ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin II receptor blocker.

**Table S4. Clinical characteristics of FM and NFM patients matched by age and sex**

| Characteristics | FM (113) | NFM (113) | *P* |
|---|---|---|---|
| Female | 37 (32.7) | 41 (36.3) | 0.675 |
| Age, y | 31.00 [19.00, 48.00] | 29.00 [19.00, 44.00] | 0.276 |
| TFOHA, d | 3.00 [2.00, 6.00] | 3.00 [2.00, 4.00] | 0.022 |
| LOS, d | 11.00 [9.00, 14.00] | 7.00 [5.00, 10.00] | <0.001 |
| Smoking status | | | 0.222 |
| Never | 89 (78.8) | 97 (85.8) | |
| Former or Current | 24 (21.2) | 16 (14.2) | |
| Drinking status | | | |
| Never | 104 (92.0) | 101 (89.4) | 0.647 |
| Former or Current | 9 (8.0) | 12 (10.6) | |
| ECG at admission | | | |
| ST-T segment abnormalities | 76 (67.3) | 48 (42.5) | <0.001 |
| Advanced AV block | 16 (14.2) | 1 (0.9) | <0.001 |
| VT/VF | 7 (6.2) | 0 (0.0) | <0.001 |
| Cardiac arrest | 10 (8.8) | 0 (0.0) | <0.001 |
| Echocardiography at admission | | | |
| LVEF | 32.00 [24.00, 46.00] | 57.00 [50.00, 61.00] | <0.001 |
| Admission laboratory tests | | | |
| cTnI, pg/mL | 19675.60 [4108.30, 45516.70] | 3226.60 [506.30, 8498.80] | <0.001 |
| NT-proBNP, pg/mL | 4567.00 [2004.00, 10591.00] | 650.00 [199.00, 1655.00] | <0.001 |
| ALT, U/L | 52.00 [28.00, 137.00] | 24.00 [18.00, 41.00] | <0.001 |
| AST, U/L | 136.00 [64.00, 262.00] | 45.00 [30.00, 90.00] | <0.001 |
| Scr, umol/L | 81.00 [65.00, 109.00] | 70.00 [59.00, 85.00] | 0.008 |
| Serum potassium, mmol/L | 4.15 [3.85, 4.50] | 3.94 [3.71, 4.24] | 0.008 |
| LDH, U/L | 487.00 [318.00, 739.00] | 248.00 [178.00, 332.00] | <0.001 |
| CRP, mg/L | 40.00 [13.00, 79.00] | 12.00 [4.00, 57.00] | <0.001 |
| ESR, mm/H | 11.00 [5.00, 19.00] | 10.00 [5.00, 18.00] | 0.915 |
| CMR performed | 99 (87.6) | 97 (85.8) | 0.845 |
| EMB performed | 39 (34.5) | 32 (28.3) | 0.390 |
| Primary outcome[$] | 57 (50.4) | 43 (38.1) | 0.082 |
| Time to event | 18.00 [6.00, 54.00] | 36.00 [6.00, 54.00] | 0.269 |
| Secondary outcomes | 50 (44.2) | 21 (18.6) | <0.001 |

Values are median (interquartile range) or n (%). FM, fulminant myocarditis; NFM, non-fulminant myocarditis; TFOHA, time from onset to hospital admission; LOS, length of stay; AV, atrioventricular; VT, ventricular tachycardia; VF, ventricular

fibrillation; LVEF, left ventricular ejection fraction; cTnI, cardiac troponin I; NT-proBNP, N-terminal pro-B-type natriuretic peptide; ALT, alanine aminotransferase; AST, aspartate aminotransferase; Scr, serum creatinine; LDH, lactate dehydrogenase; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate.

**Table S5. In-hospital treatment of FM and NFM patients matched by age and sex**

| Characteristics | FM (113) | NFM (113) | *P* |
|---|---|---|---|
| Temporary MCS devices | | | |
| IABP | 106 (93.8) | 0 (0.0) | <0.001 |
| Days | 4.00 [3.00, 6.00] | 0.00 [0.00, 0.00] | <0.001 |
| ECMO | 29 (25.7) | 0 (0.0) | <0.001 |
| Days | 0.00 [0.00, 2.00] | 0.00 [0.00, 0.00] | <0.001 |
| Pacemaker | 28 (24.8) | 0 (0.0) | <0.001 |
| Days | 0.00 [0.00, 0.00] | 0.00 [0.00, 0.00] | <0.001 |
| Other support devices | | | |
| CRRT | 32 (28.3) | 0 (0.0) | <0.001 |
| Hours | 0.00 [0.00, 12.00] | 0.00 [0.00, 0.00] | <0.001 |
| CPR/Defibrillation | 14 (12.4) | 0 (0.0) | <0.001 |
| Immunoregulatory therapy | | | |
| Immunoglobulin | 112 (99.1) | 78 (69.0) | <0.001 |
| Glucocorticoids | 113 (100.0) | 99 (87.6) | 0.001 |
| Other drugs therapy | | | |
| Inotropes | 53 (46.9) | 0 (0.0) | <0.001 |
| Antiviral drugs | 108 (95.6) | 96 (85.0) | 0.014 |
| ACEI/ARB | 72 (63.7) | 51 (45.1) | 0.008 |
| Beta blockers | 66 (58.4) | 57 (50.4) | 0.285 |

Values are median (interquartile range) or n (%). FM, fulminant myocarditis; NFM, non-fulminant myocarditis; MCS, mechanical circulation support; IABP, intra-aortic ballon pump; ECMO, extracorporeal membrane oxygenation; CRRT, continuous renal replacement therapy; CPR, cardiopulmonary resuscitation; ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin II receptor blocker.

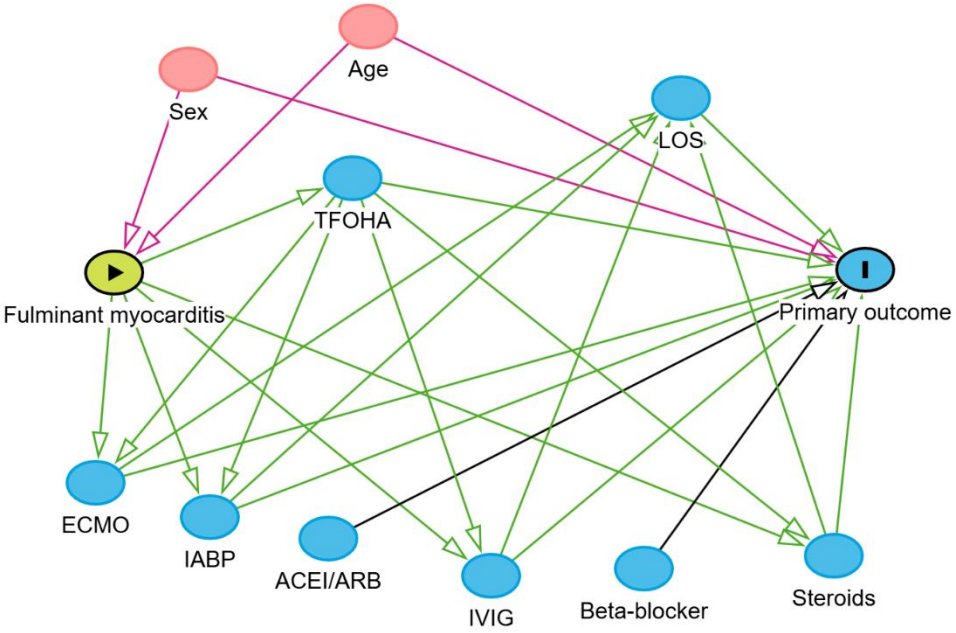


**Figure S1.** Directed Acyclic Graph (DAG) of the association between fulminant myocarditis (exposure) and primary outcome. TFOHA, time from onset to hospital admission; LOS, length of stay; ACEI, angiotensin-converting enzyme inhibitors; ARB, angiotensin II receptor blocker; IVIG, intravenous immunogloblin; IABP, intra-aortic ballon pump; ECMO, extracorporeal membrane oxygenation.

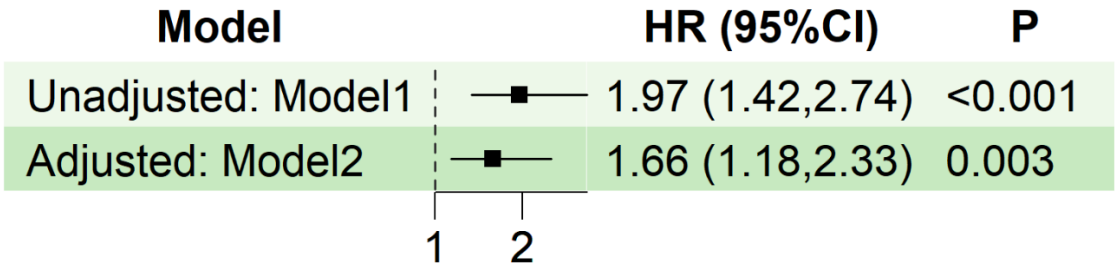


**Figure S2.** Forest presents the association between secondary outcome (persistently elevated cardiac troponin I) and primary outcome in the entirety of patient population. Model 1 shows unadjusted associations and Model 2 adjusts for age and sex. Results are presented as hazard ratios (HR) with 95% confidence intervals (CI).

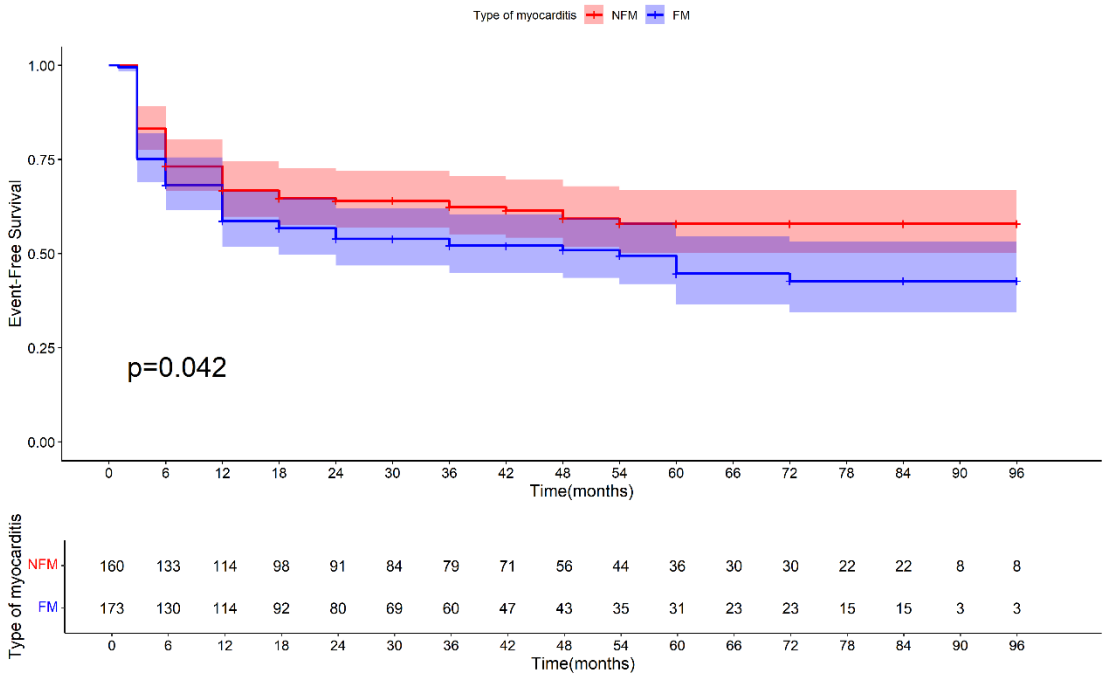


**Figure S3.** Survival analysis of primary outcome of fulminant myocarditis (FM) versus non-fulminant myocarditis (NFM) in adult patients (≥15 years).

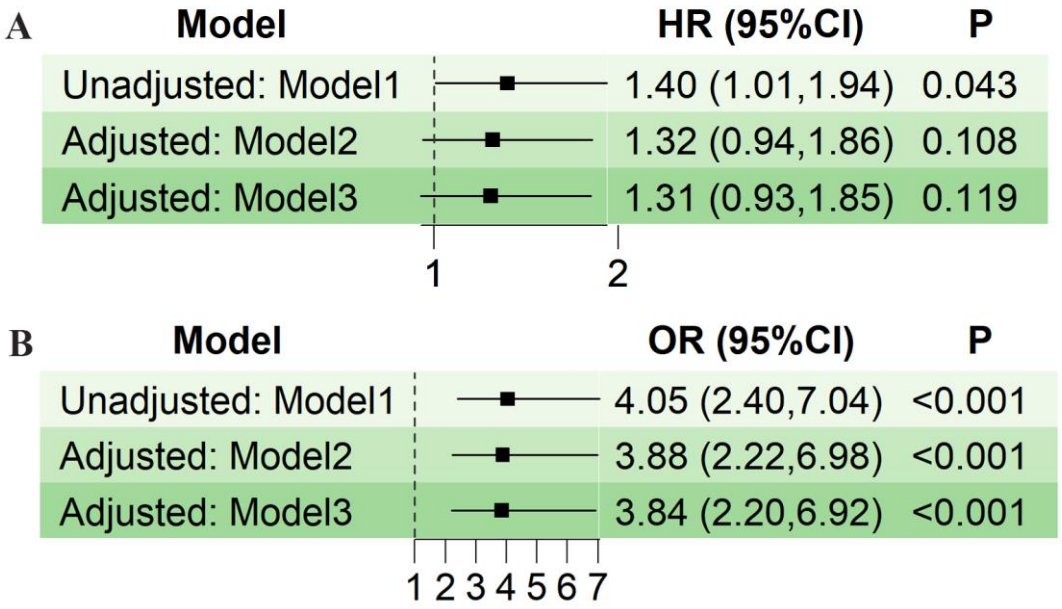


**Figure S4.** Forest plots comparing outcomes between fulminant and non-fulminant myocarditis using progressively adjusted models. Model 1 shows unadjusted associations, Model 2 adjusts for age and sex, and Model 3 additionally incorporates time from symptom onset to hospitalization. Analyses employed marginal effect Cox regression (for time-to-event outcomes) and logistic regression (for binary endpoints), with robust variance estimation to account for study-level clustering. Results are presented as hazard ratios (HR) or odds ratios (OR) with 95% confidence intervals

(CI). (A) The primary outcome is examined in adult patients (≥15 years). (B) The secondary outcome is evaluated in adult patients (≥15 years).

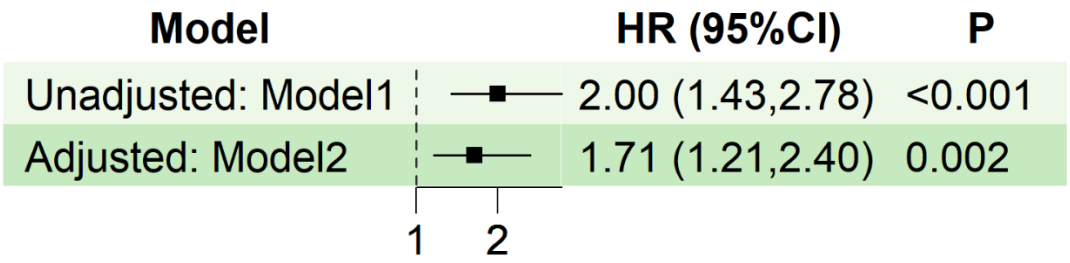


**Figure S5.** Forest presents the association between secondary outcome (persistently elevated cardiac troponin I) and primary outcome in adult patient (≥15 years). Model 1 shows unadjusted associations and Model 2 adjusts for age and sex. Results are presented as hazard ratios (HR) with 95% confidence intervals (CI).

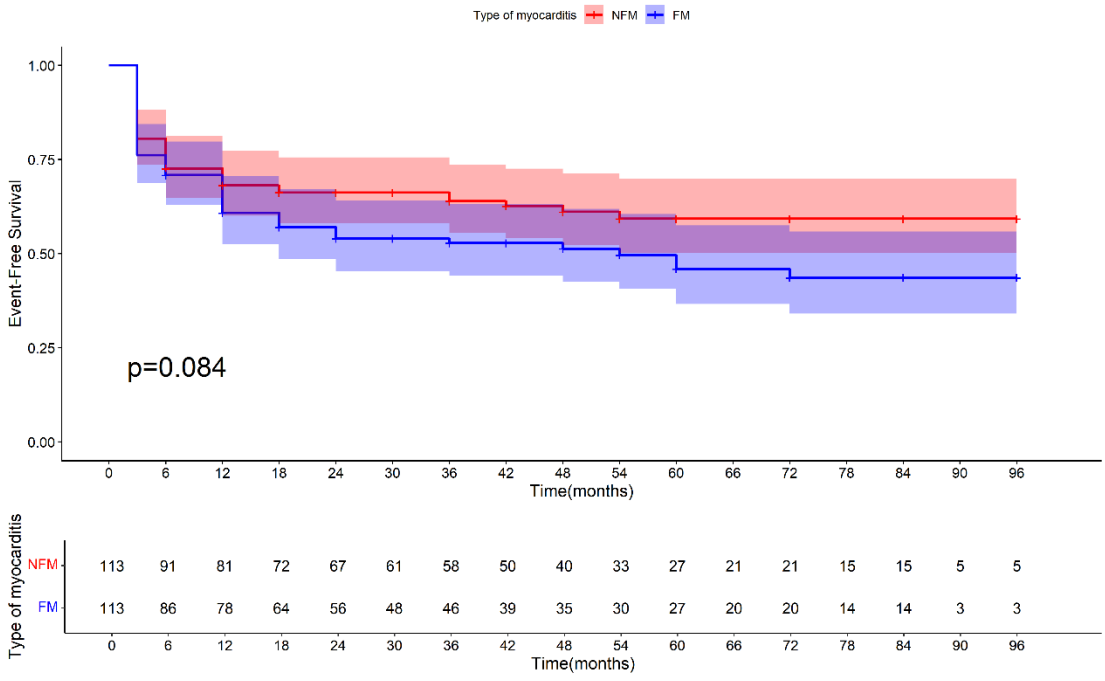


**Figure S6.** Survival analysis of primary outcome of fulminant myocarditis (FM) versus non-fulminant myocarditis (NFM) in patients with matched age and sex by propensity score.

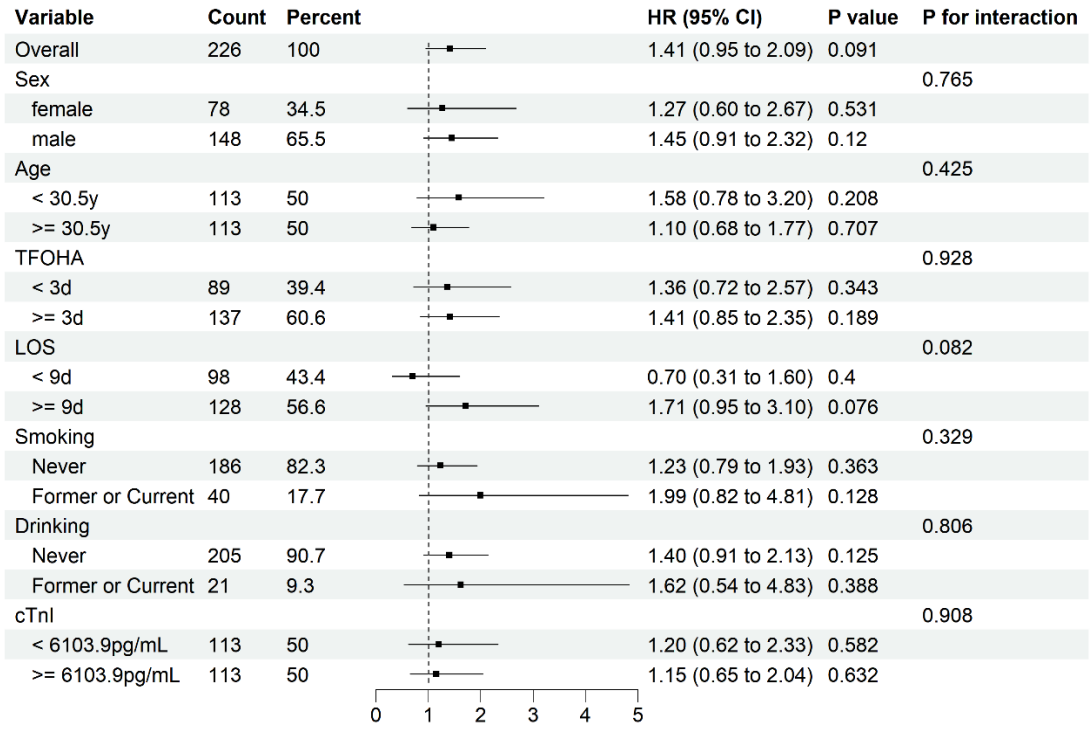


**Figure S7.** A subgroup analysis was conducted for primary outcome in patients with matched age and sex by propensity score (fulminant myocarditis vs. non-fulminant myocarditis). HR, hazard ratio; CI, confidence interval; TFOHA, time from onset to hospital admission; LOS, length of stay; LVEF, left ventricular ejection fraction. All continuous variables were dichotomized at their median values.