

## Characteristics of Cardiac Injury in Critically Ill Patients With Coronavirus Disease 2019

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## e-Appendix 1.

### Supplemental Material

#### e-Methods

#### Electrocardiogram analyses and echocardiographic measurements

Electrocardiogram (ECG) signs of right ventricular (RV) strain were defined by T waves inversion in leads V1-V4, a QR pattern in V1, a S1Q3T3 pattern, or incomplete or complete right bundle branch.<sup>1</sup> ECG signs of left ventricular (LV) hypertrophy were defined by (i) a Sokolow–Lyon index  $>35$  mm, (ii) a R in aVL  $>11$  mm, (iii) a Cornell voltage duration product  $>2440$  mm.ms, or (iv) a Cornell voltage  $>28$  mm in men or  $>20$  mm in women.<sup>2</sup>

All transthoracic echocardiography measurements were performed with a Philips CX 50 (Philips Healthcare, DA Best, The Netherlands) or a Vivid E9 (GE Healthcare, Horten, Norway). All measurements were averaged on three consecutive end-expiratory measurements in patients with sinus rhythm and five consecutive end-expiratory measurements in patients with atrial fibrillation.<sup>3</sup> All contours were hand-drawn.

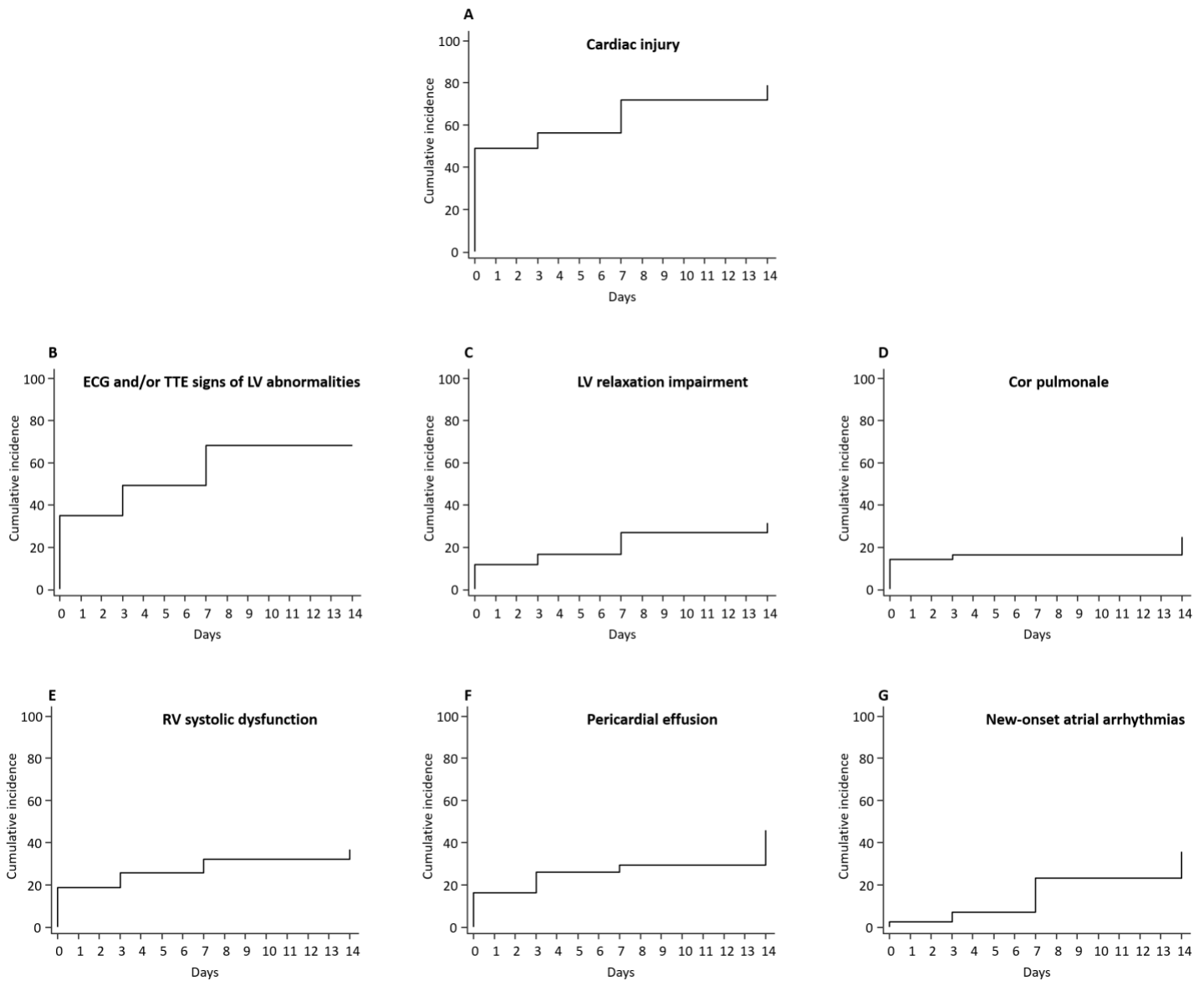
Long-axis and short-axis parasternal views as well as apical five, four, three and two-chamber views were recorded. From the apical five- and four-chamber views, we measured: the left atrial area, the early (E) and atrial (A) peak velocities of the mitral flow with pulsed Doppler, the early diastolic ( $e'$ ) peak velocity of the lateral and septal mitral annulus with Tissue Doppler Imaging, the tricuspid annular plane systolic excursion, the systolic tricuspid annular velocity with Tissue Doppler Imaging, the tricuspid regurgitant jet velocity and the LV and RV end-diastolic areas (LVEDA and RVEDA). From these variables, we calculated  $e'$  averaged, the E/A, E/ $e'$  and RVEDA/LVEDA ratios. RV dilation was defined by a RVEDA/LVEDA ratio  $>0.6$ . The LV ejection fraction and left atrial volume were calculated by the modified Simpson's rule. The systolic pulmonary artery pressure was estimated from the tricuspid regurgitant jet velocity. The LV mass was estimated from LV linear dimensions acquired from 2D long-axis parasternal view as recommended. LV hypertrophy was defined by a LV mass  $>95$  g/m<sup>2</sup> in women and  $>115$  g/m<sup>2</sup> in men.<sup>4</sup>

## e-References

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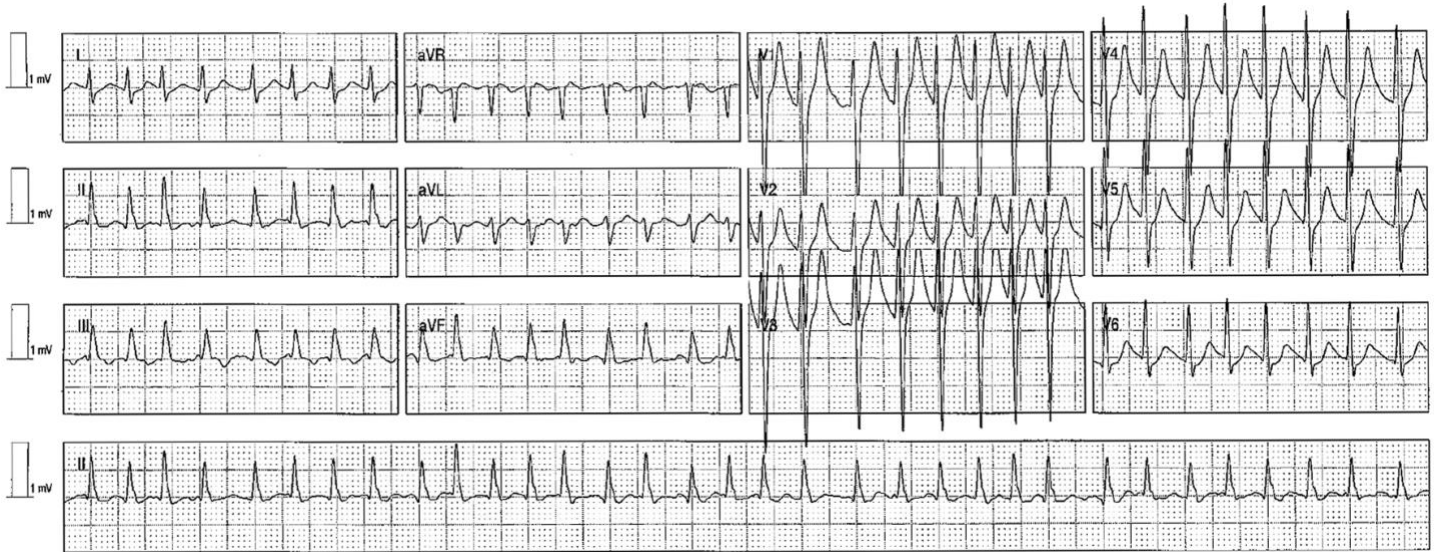
**e-Figure 1**

Cumulative incidence of cardiac injury (panel A) and of the different electrocardiographic and echocardiographic abnormalities (panel B-G) in the whole population (n=43) within the first 14 days of intensive care unit stay. ECG: electrocardiogram; LV: left ventricular; RV: right ventricular TTE: transthoracic echocardiography.



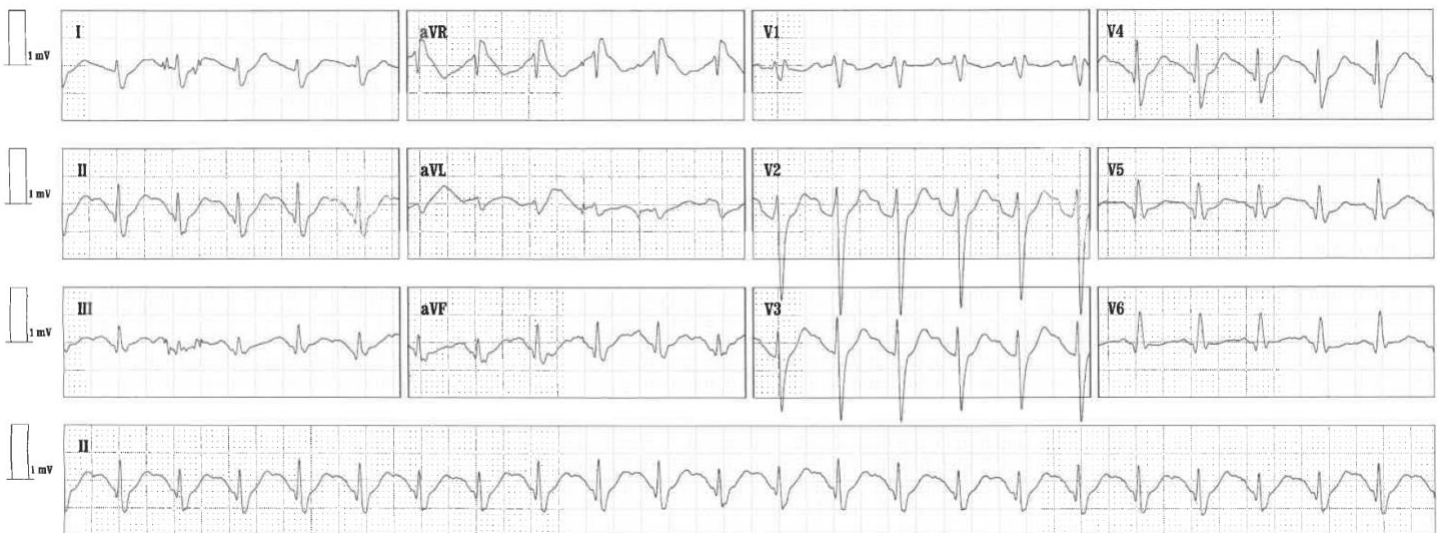
**e-Figure 2**

Twelve-lead electrocardiogram of patient 31: rapid atrial fibrillation.



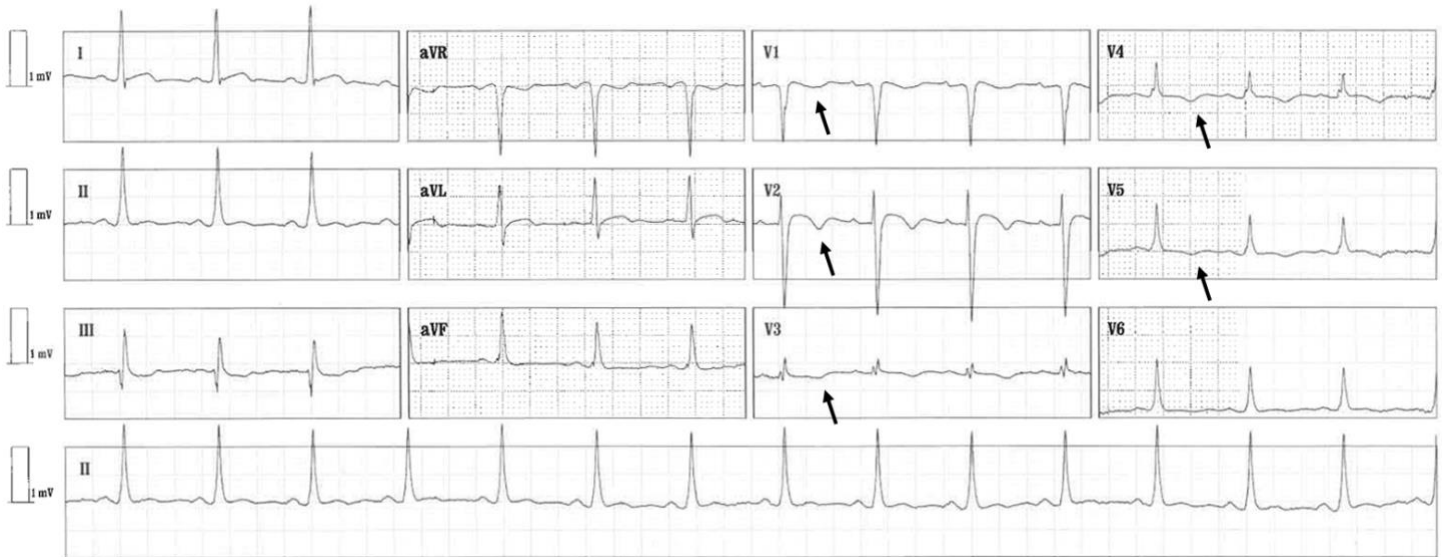
**e-Figure 3**

Twelve-lead electrocardiogram of patient 8 with confirmed pulmonary embolism: sinus tachycardia, complete right-bundle branch and S1Q3T3 pattern suggestive of right ventricular strain.



**e-Figure 4**

Twelve-lead electrocardiogram of patient 9 with confirmed significant lesion of the left anterior descending coronary artery: anterior inverted T waves (arrows) suggestive of acute coronary syndrome (non-ST segment elevation myocardial infarction).



Videos legends

**Video 1**

Transthoracic echocardiography (four-chamber view) of patient 31: left (decreased left ventricular ejection fraction) and right (decreased tricuspid annular systolic plane excursion at 9 mm) ventricular systolic dysfunction induced by rapid atrial fibrillation.

**Video 2**

Transthoracic echocardiography (four-chamber view) of patient 8 with confirmed pulmonary embolism: right ventricular dysfunction (decreased tricuspid annular systolic plane excursion (12 mm)) and dilation associated with pericardial effusion.

**Video 3**

Transthoracic echocardiography (parasternal long axis view) of patient 9 with confirmed significant lesion of the left anterior descending coronary artery: septal and apical hypokinesia suggestive of acute coronary syndrome (non-ST segment elevation myocardial infarction) and pericardial effusion.