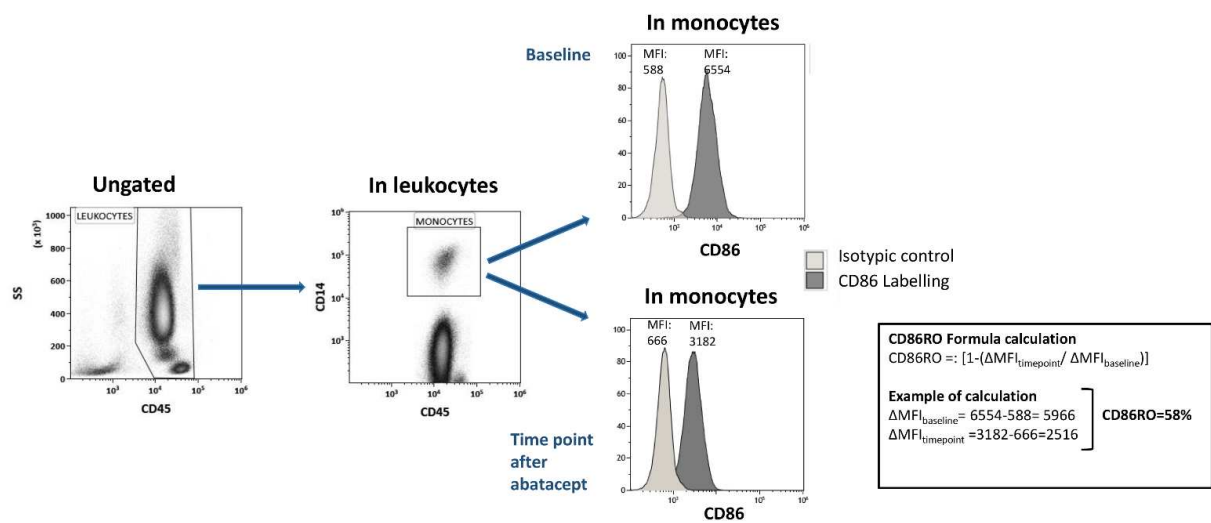


## **Supplementary Methods**

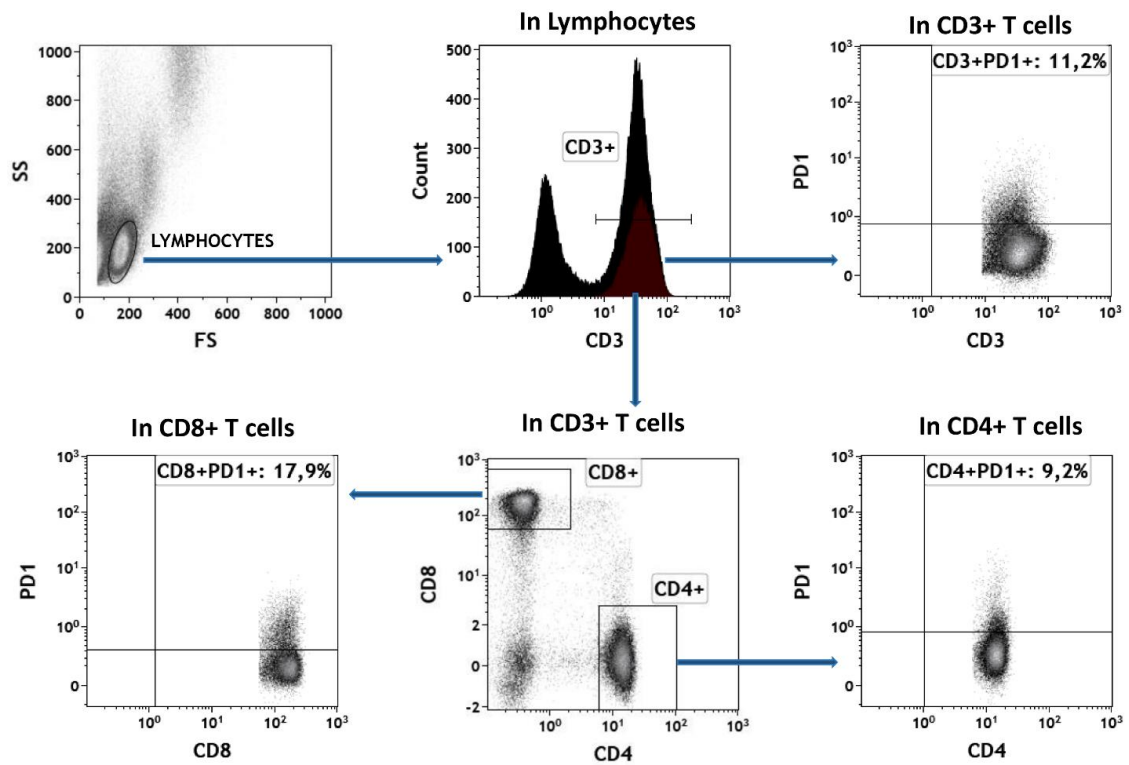
### *Abatacept and pembrolizumab therapeutic drug monitoring*

It was performed using abatacept and pembrolizumab drugs to prepare calibration and quality control. For each time point studied, blood was collected using a pre-heparinized tube. The plasma was extracted by centrifugation of blood at 3500 rpm for 10 minutes. Plasma samples were then analyzed using ultra-performance liquid chromatography system coupled to mass spectrometry (LC-MS/MS;MS-8060,Shimadzu,Japan). Quantifications were achieved in multiple reactions monitoring mode, and electrospray ionization was operated in a positive mode. Peak integration and quantification were performed using LabSolutions and Insight LC-MS software. Abatacept and pembrolizumab were quantified with signature peptide MHVAQPAVVLASSR, DLPLTFGGGTK respectively, by nano-surface and molecular-orientation limited (Shimadzu, Japan).

**Supplementary-Figure-1.** Gating strategy for CD86 expression analysis by monocytes and CD86RO calculation: circulating monocytes were gated in leukocytes as CD45+CD14+ cells. CD86 mean fluorescence intensity by monocytes was then analyzed and compared to an isotypic control. The figure shows a representative labeling at baseline before treatment and at one time point during the follow up with the detailed calculation of the CD86RO from the formula.

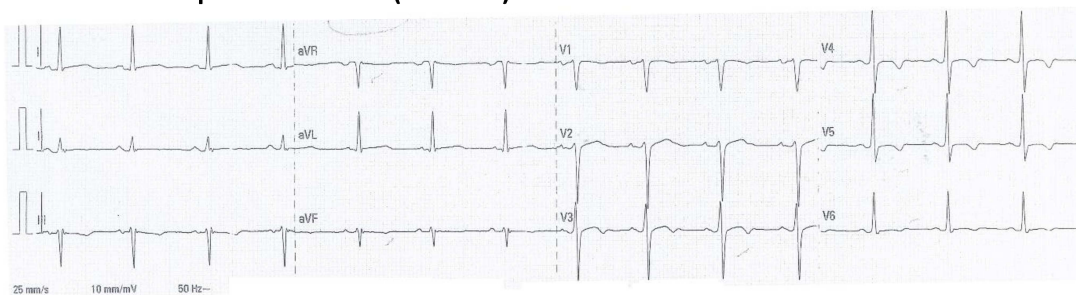


**Supplementary-Figure-2.** Gating strategy for PD1 expression in T-Lymphocyte populations: CD3+ T-cells were gated in lymphocytes gate, CD4+ and CD8+ T-cells were then gated in CD3+ T-cells. The % of PD1+ cells were then determined in each population (i.e. CD3+ T-cells, CD4+ T-cells and CD8+ T-cells).

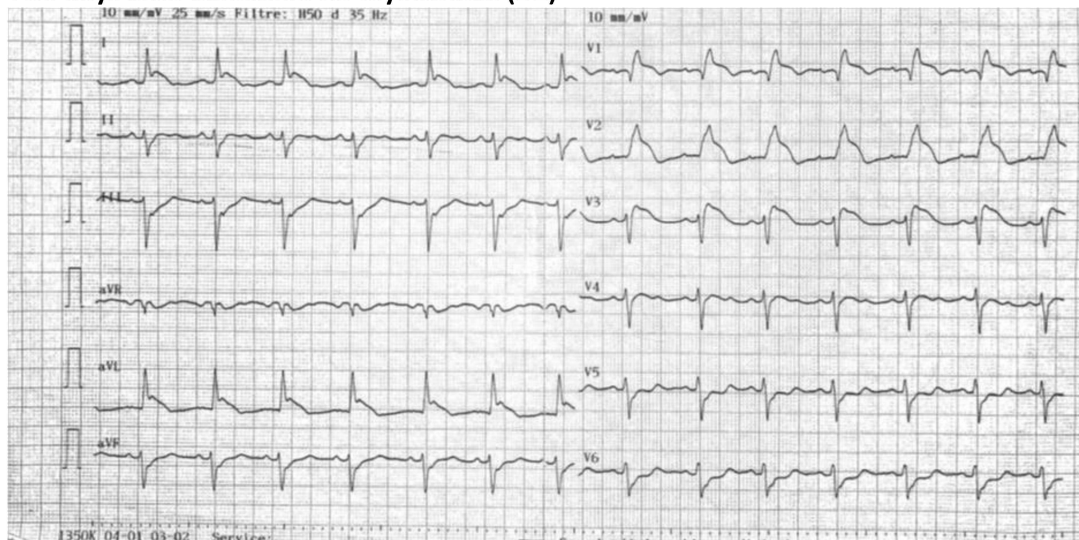


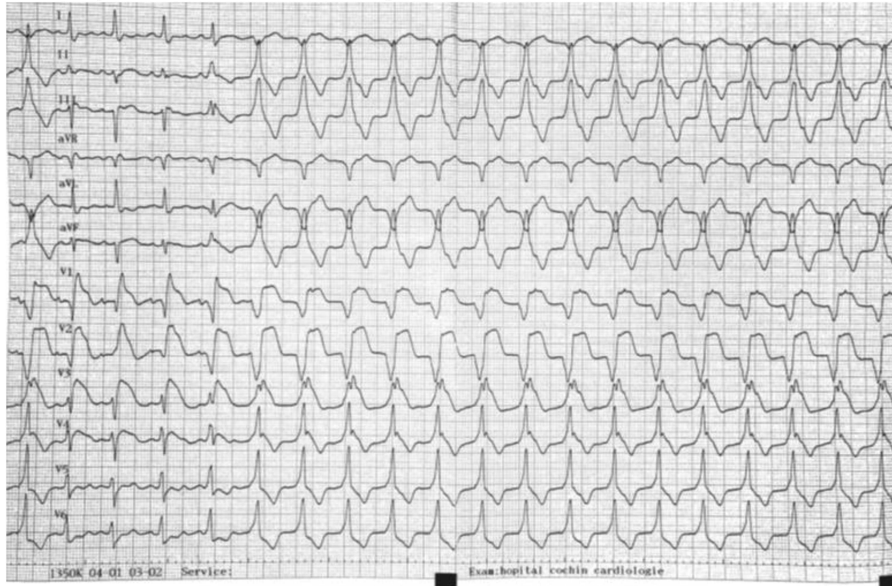
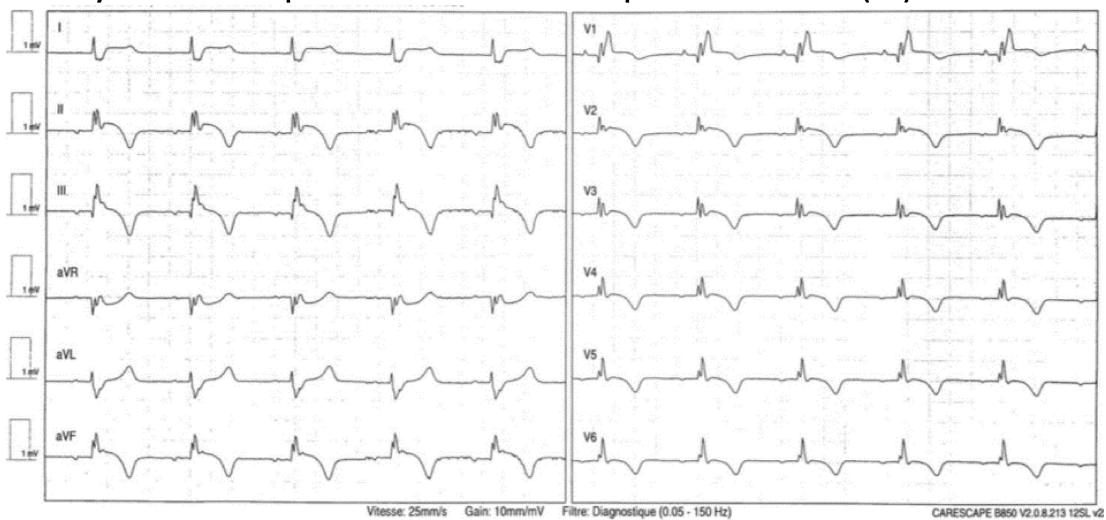
**Supplementary-Figure-3. Evolution of full electrocardiograms through the ICI-myocarditis event.** Baseline before ICI (baseline), day 2 (D2) after admission for myocarditis, D7 (cardiogenic shock, 24 hours before abatacept and ruxolitinib administration), D9 and D17. At baseline, QRS duration (80 msec) and Sokolow-Lyon voltage criteria (2.2mV) were normal. On D2, QRS duration increased (150 msec) and voltage decreased (0.7mV), with appearance of right bundle branch block and Q-waves in anterior leads; identified as predictors of poor outcomes in ICI-myocarditis.<sup>10</sup> At D7 (before abatacept/ruxolitinib), these latter ECG features deteriorated associated with accelerated ventricular rhythm, which reversed to regular sinus rhythm after abatacept and ruxolitinib treatment within 48 hours with progressive improvement of ECG features (QRS at D9: 120msec, 0.7mV). At D17, QRS width and voltage restored to approximately normal baseline values (82msec and 1.6mV) and Q-waves and right bundle branch block disappeared.

#### Baseline before pembrolizumab (Baseline)



#### Two days after admission for myocarditis (D2)



**Two days after admission for myocarditis, in accelerated idiopathic ventricular rhythm (D7)****Two days after abatacept and ruxolitinib start on top of corticosteroids (D9)****One week after abatacept and ruxolitinib start on top of corticosteroids (D17)**