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**Topic(s)** Artificial Heart & Cardiac Assist Devices, Artificial Lung and ECMO

**Preview** Minimal model of cardiovascular system assisted by a veno-arterial extracorporeal membrane oxygenation

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**Background:** Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) is often used for patients with cardiogenic shock. A mathematical model of the cardiovascular system assisted by a VA-ECMO could be helpful to provide a better understanding of the dynamics of the system. Broomé et al (J. Tranl Med, vol. 14, no. 1, pp. 4, 2016) have already built such a mathematical description but their model is very complex (32 compartments for the cardiovascular system and 1 ECMO compartment) and its many parameters cannot be identified with the data available in intensive care unit (ICU). Their model is thus very hard to be made patient-specific. On the other hand, a minimal model of the cardiovascular system was proposed in Pironet et al. (Computer Methods and Programs in Biomedicine, vol. 21, pp. 1-13, 2017) and shown identifiable in ICU.

**Aim:** The purpose of our work is to complement the cardiovascular model of Pironet et al. by an additional compartment describing the VA-ECMO and to build a tool that could help clinicians in their therapeutic approach.

**Methods:** The mathematical model is based on the model by Pironet et al., to which an additional pump is connected, which takes a fraction of blood in the vena cava, oxygenates it and rejects it in the aorta. This model can be identified by using data available in the ICU. Experimental data obtained from the experiments of Ostadal et al. (J. Tranl Med, vol. 13, no. 1, pp. 266, 2015) are used to determine the values of 5 parameters of the model.

**Result:** The results show an excellent agreement between the simulations and the experimental data. The minimal model, which is identifiable in ICU, is able to reproduce the experimental data and can thus be considered as validated.

**Conclusion:** A mathematical model of the cardiovascular system assisted by a VA-ECMO has been built and validated with experimental data. This model is identifiable in ICU and could thus be used at the patient bedside, in order to improve the therapeutic approach.