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Talk announcement

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Modelling and numerical simulation of Veno-Venous Extra-Corporeal Membrane Oxygenation (VV-ECMO)

Extra-Corporeal Membrane Oxygenation (ECMO) is a well-established procedure used in Intensive- Care Units (ICU) to treat patients with either pulmonary or heart failure. The blood of the patient is drawn via a cannula, oxygenated and injected via another cannula. The extraction cannula is normally located in the inferior vena cava. In the case of lung failure, but with a heart in good conditions, the injection cannula is placed in the superior vena cava (veno-venous, VV-ECMO). In the case of heart failure, the injection cannula is placed in the aorta (veno-arterial, VA-ECMO) to ensure that the blood is actually pumped across the arterial system. VV-ECMO is the standard procedure in the case of Severe Acute Respiratory Syndrome and is currently used for Covid-19 patients in ICU. A known clinical problem for VV-ECMO is recirculation, where a significant portion of the fully oxygenated blood appears to be recaptured by the extraction cannula in the inferior vena cava, instead of joining the normal circulation pathway [1]. This results in a limited efficacy of the procedure: blood is inserted fully oxygenated but distal measurements show values as low as 80In this talk we will present our work on patient-specific modelling and simulation of VV-ECMO, a surprisingly uncharted territory in the current scientific literature. We will describe the major modelling challenges that ECMO poses, with a particular focus on the proper description of the blood flow. The patient geometry is reconstructed from a CT scan, while blood flow and oxygen diffusion are approximated by the Finite Element Method. We will present numerical results showing how poorly the standard VV-ECMO actually performs and we will discuss possible optimisation procedures or best practices to improve its effectiveness.