

Virtual ACS 2021 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

Research In-Progress

Training Simulator for Extra-corporeal Membrane Oxygenation (ECMO)

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Introduction: Extracorporeal Membrane Oxygenation (ECMO) is a life support procedure that enables the bypass of heart and lungs in case of severe cardiogenic shock and respiratory failure. Traditional ECMO training is focused on didactic lectures, hands-on training with ECMO equipment and discussion. It is thus imperative to develop a training simulator that trains on this procedure and the complications associated with it. In this abstract, we present the design of a training simulator we developed for ECMO that will train the medical professionals acquire the skills required to perform this procedure on real patients.

Methods: The training simulator developed has three main parts: (1) cardiovascular circuit that has a programmable pump to mimic the human heart and produce physiological fluid output. It has replaceable cannulation pads to perform cannulation and a synthetic vasculature. (2) ECMO circuit that has an external pump to regulate the simulated blood and different sensor probes such as flow, temperature and pressure to monitor the vitals thus simulating the ECMO procedure and (3) interfacing the task trainer with the human physiological model to simulate different clinical scenarios like hypovolemia, hypoxia, etc.

Preliminary Results: The cannulation pad developed to perform cannulation was proven to be ultrasound compatible. Also, the oxygenation procedure (from deoxygenated to oxygenated blood) was successfully simulated using a blood simulation. A sample case of hypovolemia was simulated by integrating this system with the virtual physiology engine. Results showed that the decrease in blood volume due to hemorrhage scenario caused the programmable pump (artificial heart) to run faster thus representing faster heart rate.

Next Steps: The next step is to validate the simulator and develop a curriculum that will give access to trainees to evaluate and treat a simulated patient using the ECMO simulator. This will include cannulation, initiation and management of a simulated patient.

Display monitor to show vitals



BioGears Physiology Engine

Cardiovascular circuit

