Supplement 1: key construction steps

	Passing an Impella CP head through a 3/8"- 3/8"- 3/8"-Y piece.
	Narrowing 3/8" tube diameter to 1/4" by two 3/8"-1/4" connectors, and constricting the 1/4" tube around the Impella by cable ties.
	Passing an Impella 5.0 through 3/8-3/8- 1/2"-Y piece (marginal fit, only with wiggling) or an 1/2"-1/2"-1/2"-Y piece, adding a short 3/8 silicon tube (fits on 1/2" port), constricting with 2 cable ties; adding a 3/8"-3/8" connector.
	Avoiding backflow around Impella 5.0 inside 3/8 silicon tube by adding a short 1/4" PVC tube segment (star) on Impella conduit, fixated by cable ties.
	Occluding the Impella 5.0 entry port using a flexible silicon plug (star; 2 sterile spare silicon plugs come with Impella 5.0 package) fitting inside the 3/8 silicon tube and occluded with cable ties.
	Occluding an Impella CP entry port using a cannula stepdown from 3/8" to 1/4" by connector or coaxial tubes, multiple cable ties, and staggered standard shrink tubes. (Spare silicon plug from Impella 5.0 package, see above, also fits to Impella CP and is preferably used if available)
	Facilitating cannula caliper jumps by coaxial tubes, shrink tubes, cable ties. Applying cable ties in adjacent pairs in different orientation minimizes leakage.
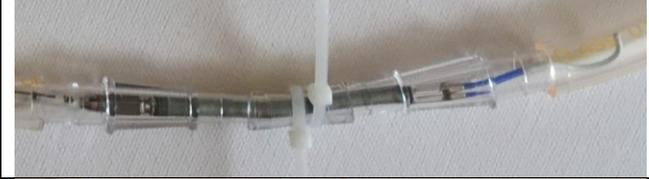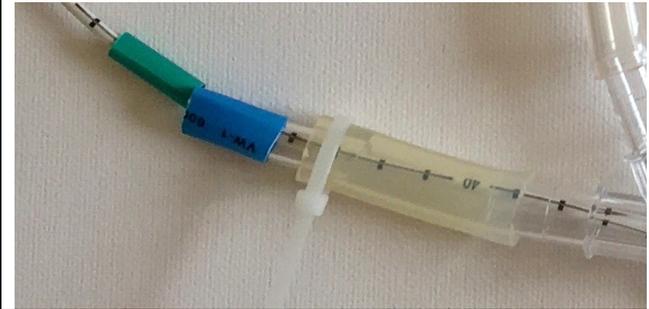
Supplement 2: Materials, Compatibilities, Tricks & Tips

Materials	Example
Abiomed Impella pump	Abiomed Impella CP, Impella 5.0
Abiomed Impella pump console	Abiomed AIC console
Gas exchange module qualified for long-term use	Medos Hilite 7000LT
PVC Tubes for ECMO: 3/8" PVC, 1/4" PVC, preferably with anticoagulant coating)	Medos Rheoparine connection line
Silicon tubes 3/8", (optional, Silicon 1/4")	
Y-pieces: 3/8"-3/8"-3/8" for Impella CP	e.g., HMT, Maisach, Germany
Y-pieces: 3/8"-3/8"-1/2" or 1/2" -1/2" -1/2" for Impella 5.0	e.g., HMT, Maisach, Germany
Tube connectors: 3/8"-3/8", and 3/8"-1/4" stepdown	e.g., HMT, Maisach, Germany
Venous cannulas	
- Femoral venous drainage, large-bore	Medtronic Biomedicus 25F 60cm cannula
- Jugular venous return	Medtronic 22F 15cm cannula
- Optional: Dual lumen catheter for single site access. Prefer large bore.	Getinge Avalon Elite, (Medos Novaport Twin 24F)
Cable ties	Standard cable ties
Shrink tubes (optional)	Shrink tubes with diameters ranging from largest tube used, down to a shrunk diameter of 2.5mm (= Impella shaft diameter)
Tricks, Tips, Compatibilities	
Use the Impella guidewire to pass the Impella pump head through Y-pieces and tubes	
In general, use standard 3/8 PVC tubes, preferably with heparin coating, and have short pieces of 1/4" PVC and 3/8" silicon tubes ready for specific tasks	
Use gas exchange module suited/qualified for prolonged ECMO use, e.g. polymethylpentene gas exchanger.	
Impella CP - specifics	
Impella CP fits through 3/8"-3/8"-3/8" Y piece or larger	
Impella CP fits through 1/4", 3/8", and 1/2" tubes and connectors	
Impella 5.0 - specifics	
Impella 5.0 does not fit through 3/8"-3/8" -3/8" Y piece	
Impella 5.0 fits through 3/8"-3/8" connectors and tubes	
Impella 5.0 does not fit through 1/4" tube or connector.	
Even 1/2" connectors/ ports accept 3/8 silicon tube, resulting in smooth diameter transitions	

Supplement 3: Multiday testing

Multiday test runs were done first in a simple closed loop system (Figure 1F) with saline and then in a complete system incorporating the Impella pump, venous drainage and return catheters and gas exchange modules with reconstituted blood from packed red blood cells and fresh frozen plasma at a hematocrit of 30% with heparin anticoagulation. Flows and pressures were determined using the sensors built into the Impella catheters/consoles and using external pressure sensors. Oxygenators were tested visually for clot formation and pressure gradients were determined over time. In the setup using two sequential gas exchange modules (the first flushed with N2 for partial deoxygenation and the second flushed with O2 for oxygenation), gas exchange over time was monitored by blood gas analysis.