#15	Implementation of a Fully Instrumented Closed-Chest Porcine Cardiovascular Research Model: A Stepwise Approach to Multivessel Instrumentation and Hemodynamic Monitoring	Mary Jane (1) Kay Everett (2) Veronika Liskova (3) Margi Baldwin (4)	University of South Florida, USF Health Heart Institute (1-3) University of South Florida, Division of Comparative Medicine (4)	Abstract

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Implementation of a Fully Instrumented Closed-Chest Porcine Cardiovascular Research Model: A Stepwise Approach to Multivessel Instrumentation and Hemodynamic Monitoring

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Introduction

Translational cardiovascular research increasingly relies on large-animal models that require hemodynamic monitoring, coronary intervention, heart failure induction, and mechanical circulatory support. Establishing these complex models demands extensive vascular access planning and precise catheter placement. This presentation describes a stepwise approach to implementing a fully instrumented closed-chest porcine cardiovascular model using percutaneous vascular access and fluoroscopic guidance in a non-survival model.

Methods

Seventy-to-one-hundred-kilogram swine were induced with an intramuscular Telazol, ketamine, and xylazine cocktail (Telazol 5.5 mg/kg, Ketamine 3 mg/kg, Xylazine 1 mg/kg) and maintained under 2% Isoflurane inhaled anesthesia. Following endotracheal intubation, bilateral auricular vascular catheters and a transesophageal echocardiography probe were placed in left lateral recumbency. Animals were then transferred to an interventional radiology suite for vascular access and instrumentation.

Arterial and venous vascular access using 7-12Fr sheaths was obtained using 1D doppler-guided Seldinger technique to support simultaneous monitoring and intervention. Access included bilateral jugular, bilateral carotid, and bilateral femoral venous and arterial vessels for placement of biventricular pressure-volume catheters, pulmonary artery catheterization, renal artery catheterization, coronary artery and sinus access, medication administration, and fluid support. Serial dilation techniques were utilized for placement of large bore (17-25 Fr) peripheral veno-arterial ECMO cannulas via percutaneous or surgical intervention. Fluoroscopic guidance was employed throughout to facilitate catheter navigation, confirm positioning, and optimize instrumentation.

Animals remained under general anesthesia for the duration of the study and were euthanized with pentobarbital prior to study end. As a non-survival model, postoperative analgesia was not required.

Results

This instrumentation strategy enabled simultaneous acquisition of right and left ventricular pressure-volume measurements, pulmonary artery hemodynamics, coronary artery access, coronary sinus monitoring, myocardial infarction and heart failure induction, and veno-arterial extracorporeal membrane oxygenation support. Standardization of vascular access assignments and catheter placement improved procedural efficiency and reproducibility while facilitating consistent study execution.

Challenges encountered during instrumentation included obtaining multiple vascular access sites, serial dilation for large-bore ECMO cannula placement, and seasonal health-related concerns within the swine population. Placement of approximately ten vascular access sites required 45 to 60 minutes, while complete instrumentation required 1 to 2.5 hours depending on vascular anatomy and individual animal variation.

Complete instrumentation was achieved in 38 of 47 animals (80.9%). Animals that were not successfully instrumented included cases of equipment failure, fatal arrythmias, respiratory failure, inability to obtain left anterior descending coronary artery access, unsuccessful placement of one or more ventricular pressure-volume catheters, or vessel dissection/perforation. Successful ECMO cannulation was achieved in all but one animal; in that case, serial dilation was unsuccessful after loss of intravascular access, and the arterial cannula could not be appropriately advanced.

Conclusions

Comprehensive percutaneous instrumentation provides a versatile platform for advanced cardiovascular research in large swine. Strategic allocation of vascular access sites enables the integration of multiple monitoring and interventional modalities within a single experimental model. This presentation outlines a reproducible workflow for sequential vascular access, fluoroscopic guided catheter placement, and multimodal cardiovascular instrumentation while highlighting practical considerations encountered during model development. This approach may serve as a practical framework for investigators developing complex closed-chest cardiovascular research models.