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INTRODUCTION:
The common technique for central venous (CV) access uses ultrasound guidance to place a needle through the skin into the vessel. However, serious complications continue to occur particularly in high risk patients. Patients that have undergone repeated vascular access for management of congenital heart disease represent a group where obtaining this access may be increasingly difficult. Complication rates are also higher when less experienced practitioners attempt to gain access and more than two access attempts are required. Over 5 million CV access procedures are performed annually, a cumulative 4% rate of serious complications (pneumo-hemothorax, arterial laceration, stroke) has been reported. We describe a new retrograde (inside-out) method for intravascular access (SAFE CVAD) that allows for safer, fluoroscopically controlled, first attempt CV access even in difficult situations.

METHODS:
The Safe CVAD device is a 100 cm long 7F catheter with a deflectable tip through which a fine puncture wire is deployed from the inside of the vessel to the skin surface. Initially, percutaneous femoral venous access is obtained and using fluoroscopy a J wire is passed to the venacava and into the desired central vein. The device is passed over the wire and the tip is deflected under fluoroscopy and brought into contact with the anterior vein surface. The puncture wire is then deployed and recovered at the skin surface. A micro introducer is used to exchange the puncture wire for a standard wire followed by access placement.

RESULTS:
The SAFE CVAD was successfully used in sheep for both jugular and subclavian vein access from the inside out. Advancement of the device to the desired exit was achieved in 6 of 6 insertions, with the puncture wire exiting the skin sufficiently to permit CV access. Position of the puncture wire and rotation of the device tip to target the intended exit site was clear under imaging as there was one to one torque control from the handle to the tip. Multiple CV exit punctures from a single femoral venous entry were possible. Bleeding at the entry and exit sites was minimal and managed with compression.

CONCLUSION:
The SAFE CVAD allows for safe CV access on the first attempt avoiding the serious complications that may result from repetitive outside-in attempts. It also allows placement of the CV access at a site less prone to infection compared to the femoral region. Use of the device by less experienced practitioners may reduce and possibly eliminate the complications encountered during the learning curve when compared to using the landmark technique or ultrasound guidance.