Mechanical complications after central venous catheterization: incidence, risk factors and techniques for improvement

PhD Thesis – Half time review June 3rd, 2020
13.00-14.30, Conference room, Intensive- and Perioperative Care, Arbetsavdelningen Centralblocket, hisshall B, plan 6, Skåne University Hospital, Lund

Department of Clinical Sciences, Anesthesiology and Intensive Care, Lund University
Department of Cardiothoracic Anesthesia and Intensive Care, Skåne University Hospital, Lund

PhD student: Maria Adrian
Main supervisor: Associate professor Thomas Kander
Co-supervisors: Ola Borgquist PhD, Professor Peter Bentzer
Reviewers: Associate professor Per Ederoth, Associate professor Johan Wasselius
Background
Central venous catheterization is one of the most common invasive procedures in modern health care. Unfortunately, the catheterization procedure is associated with mechanical complications such as bleeding, pneumothorax, cardiac arrythmias and catheter misplacement. Real-time ultrasound guidance significantly reduces the number of mechanical complications. However, since the widespread introduction of ultrasound, large prospective observational studies on incidence and risk factors associated with mechanical complications are missing.

Aims and methods
I) To determine incidence and risk factors associated with mechanical complications after ultrasound-guided central venous catheterization, we designed a prospective observational study. All central venous catheters (CVCs) inserted in adult patients at four different hospitals in Region Skåne will be included. Multivariable logistic regression analysis will be used to define independent risk factors associated with mechanical complications.
II) Clinical experiences indicate that guidewires provided in commonly used 15-16 cm CVC kits are too short for ultrasound-guided CVC placement in the right subclavian vein. To explore this, we performed a retrospective observational study. Adult patients with a computed tomography scan of the chest were included. X-ray measurements of the distance from the most plausible distal puncture site of the right subclavian vein to the optimal guidewire J-tip position in the lower part of the superior vena cava were performed.

Results
I) Data collection started in March 2019 and will end when the necessary sample size of 12 537 CVC insertions has been reached (estimated in March 2021). The study protocol was published in September 2019.¹
II) X-ray measurements were performed on 50 men and 50 women. The 95th percentile of the measured vessel length was used to calculate the required minimal guidewire length. In eight of eleven 15-16 cm CVC kits the guidewires were up to 108 mm too short for ultrasound-guided CVC placement in the right subclavian vein.²

Significance
Increased knowledge about risk factors associated with mechanical complications will contribute to quality improvement of CVC insertion procedures and increased patient safety.
The use of optimal guidewire and CVC lengths for different vascular insertion sites will reduce the number of CVC misplacements.

**Publications**


2. **Adrian M**, Bengtsson P, Borgquist O, Bozovic G, Kander T. *Most guidewires used for central venous catheterization of the right subclavian vein are too short; a CT-based observational study*. Submitted to Anaesthesia & Analgesia in April 2020