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Evidence-based consensus on the insertion of central venous access devices: definition of minimal requirements for training

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Editor's key points

- This review presents consensus on standard minimal requirements for training on central venous access devices.
- An international task force generated an evidence-based consensus.
- The task force proposed 16 recommendations.
- Standardized education, simulation practice, and supervised insertions are the key to ensuring safe and competent practice.

Summary. There is a lack of standard minimal requirements for the training of insertion techniques and maintenance of central venous access devices (CVADs). An international evidence-based consensus task force was established through the World Congress of Vascular Access (WoCoVA) to provide definitions and recommendations for training and insertion of CVADs. Medical literature published from February 1971 to April 2012 regarding 'central vascular access', 'training', 'competency', 'simulation', and 'ultrasound' was reviewed on Pubmed, BioMed Central, ScienceDirect, and Scopus databases. The GRADE and the GRADE-RAND methods were utilized to develop recommendations. Out of 156 papers initially identified, 83 papers described training for central vascular access placement. Sixteen recommendations are proposed by this task force, each with an evidence level, degree of consensus, and recommendation grade. These recommendations suggest central venous access education include didactic or web-based teaching with insertion procedure, infection prevention, complications, care, and maintenance of devices, along with laboratory models and tools for simulation practice incorporating ultrasound. Clinical competence should be determined by observation during clinical practice using a global rating scale rather than by the number of procedures performed. Ensuring safe insertion and management of central venous devices requires standardized education, simulation practice, and supervised insertions.

Keywords: catheter-related infections, prevention and control; catheterization; central venous access; central venous, standards; clinical competence; competency; complications; computer-assisted instruction; consensus; evidence-based medicine; education; GRADE; guideline; humans; infection; internship and residency; programme development; programme evaluation; RAND; supervision; simulation; subclavian vein; training; ultrasound guidance; ultrasonography; vascular access; vascular surgical procedures

Education surrounding the insertion of central venous access devices (CVADs) remains undefined. Training is defined as the acquisition of knowledge, skills, and competence related to a specific activity or procedure. Understanding and establishing the level of education required for safe insertion procedures and management of CVADs is the focus of this publication. There is variability of knowledge and competency among inserters which is represented quantitatively by the number of complications that occur from patient to patient.[1] It has been demonstrated that a systematic training process, including ultrasound instruction before patient insertions, reduces mechanical and infectious complications.[2–6]

Current CVAD literature related to training, supervision, and competence acquisition does not define a fully standardized programme for trainees; nor does it establish guidelines for supervisors. No standard didactic or simulation training is currently required before the insertion of CVADs by clinicians in training other than supervision of an unspecified number of insertions. The supervision requirements do not specify the role, experience, or competence of the supervisor.

Healthcare workers involved in the placement of CVADs using ultrasound guidance need appropriate education and training to ensure patient safety and avoid major complications with the insertion of CVADs.[7–10] Basic knowledge of anatomy, ultrasound physics and imaging, and infection prevention strategies have been proposed for the standard didactic education. These recommended topics are necessary for adequate understanding and safety of the insertion procedure.[11 12]

There are two areas of focus to be addressed in any CVAD educational course; insertion and management. The insertion method and site selected affect the amount of risk involved related to trauma, colonization, and the ability to complete therapy successfully. Even the decision to choose a particular type or size of device contributes to the risk for infection and the development of thrombosis.[8 13–15] Furthermore, there is a synergistic effect in which risk factors for one event may impact the incidence of other complications. For example, there is a direct association between catheter-related thrombosis and infection; the incidence of thrombosis increases with multiple insertion attempts which then increases the risk of infection.[8]

A growing body of knowledge points to simulation training as a key to safe patient insertions[3 16] by advocating competency-based education and multidisciplinary practice models.[17] Application of ultrasound guidance with CVAD insertions reduces insertion-related complications, increases success, and establishes a process for vascular access based on safety and vein preservation. The safety afforded with ultrasound-guided insertions dictates that this technique be included in the educational process of any central venous device placement.[18 19] Educational processes and supervised insertions are needed for healthcare providers to establish credentialling for CVAD procedures in any healthcare facility.[11 20] In keeping with recommendations and guidelines, standard education on principles of insertion and infection prevention practices should be provided to all CVAD inserters initially and at least annually.[7–9]

To address the issue of standardization of CVAD training, a task force was formed by the World Congress of Vascular Access (WoCoVA) with a goal to create evidence-based recommendations for minimal education and training for central venous device insertion and management.

Methods

Eight worldwide educational course experts on vascular access device placement, not supported by industry, were identified by WoCoVa in 2010 to create an evidence-based consensus[21] on minimal requirements in training in central venous device placement. These experts qualified based on a minimum authorship of two peer-reviewed articles published in the past 10 yr related to this topic, and additional activities including teaching and speaking on vascular access. Seven panellists accepted who then created a roadmap to achieve a final document with evidence-based recommendations on CVAD education. A search of medical literature was performed using two methods to avoid selection bias: the first method entailed a systematic search by all panel experts. Medical subject headings including 'central vascular access', 'training', 'competency', 'simulation', 'infection', 'complications', and 'ultrasound' were searched on Pubmed, BioMed Central, ScienceDirect, and Scopus databases including articles dated from February 1971 to April 2012. A professional medical librarian from the National Neurological Institute Besta in Milan supplemented this first search with a hand search based on selected articles from the expert panel. The second method entailed a systematic search of English language articles from the same period by an epidemiologist (M.E.) assisted by a professional librarian. The two bibliographies were then compared for thoroughness and consistency. Out of 156 papers initially identified, 83 papers were linked with training in vascular access. The GRADE and the GRADE-RAND methods were utilized to develop the 16 recommendations.[22–24] The GRADE method utilized two phases in the development of these evidence-based recommendations. This methodology has been previously detailed in the published literature. There are 15 factors that are typically considered in the GRADE process. The level of evidence quality was scored according to nine factors. The final classification of evidence quality was divided into three levels (A, high; B, moderate; C, low). The transformation of evidence into a recommendation was a function of the panel evaluation of five factors. The GRADE system has not standardized this decision-making process of the expert panel. In an effort to standardize this evidence processing, the methodology committee of this working group selected the Rand Appropriateness Method (RAM). The panellists held conference calls in which they discussed the topics of the Consensus and voted separately on all recommendations using a web-based voting system. The voting process required expert decisions utilizing GRADE factors such as outcome importance and evidence-to-recommendation transformers. This process provided a structured and validated method for expert panel activities. In addition, it standardized statistical methodology for determining the degree of agreement to serve as a foundation for deciding about the recommendation grade (weak *vs* strong).

Results

Eighty-three articles were analysed and voted upon according to the GRADE factors. Sixteen recommendations were proposed, each with an evidence level, degree of consensus, and recommendation grade (Table 1).

Adult learning methods

These teaching methods follow a consistent scientific approach or educational style to engage the student's mind.

The approach to teaching and learning with regard to CVAD insertion should be underpinned by a constructivism or adult learning philosophical framework such as experiential learning.