J Vasc Access 2014; 00 (00): 000-000
DOI: 10.5301/jva.5000322

REVIEW

Training and certification in dialysis access

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ABSTRACT

Decreasing and eliminating the gaps in knowledge, skills, and effective communication are the mainstays for a successful dialysis access training program curriculum and at the core of the human factors training philosophy. Many of these skills can be learned in the simulation environment. Education and training will reduce gaps in knowledge and technical skills, before exposing patients to procedure-related risk. For dialysis access, a reliable workplace environment depends upon a culture where safety and accountability are balanced to recognize the human contribution to success or failure in the complex care of patients with end-stage renal disease. Rigorous testing and certification adds value to the participants and validates the training program.

Key words: **Certification, Dialysis access simulation, Dialysis access training, Examination, Testing**

Accepted: September 9, 2014

BACKGROUND

There is a void in the training for dialysis access, including proper selection of the dialysis modality such as hemodialysis (HD) or peritoneal dialysis (PD), surgical site selection, timing of access placement, and the setting in which procedures can be safely and efficiently performed. The rapidly developing new technologies, socioeconomic forces, wide spectrum of professional experience, and bias underscore the need for comprehensive and widely accepted training curricula for dialysis access teams.

Dialysis access patient care is complex, poorly coordinated, and fragmented in nature. Providing care for the patients with end-stage renal disease (ESRD) is an economic burden to society, exceeding $40 billion a year in the United States, averaging $80,000 annually per dialysis patient (1, 2). The prevalence of chronic kidney disease has steadily increased due to the obesity epidemic, an aging population, and factors contributing to higher rates of hypertension and diabetes. Ten percent of the United States population has some degree of chronic kidney disease, with more than 900,000 patients being treated for ESRD, including about 400,000 patients on chronic dialysis. African-Americans, elderly, non-English speaking patients, and those in lower socioeconomic groups are particularly vulnerable (3-6). Until effective preventive measures can be instituted, training of ESRD stakeholders involved with dialysis access is the only way to achieve better patient-centric outcomes and improved quality of life.

INDIVIDUALS AND SYSTEMS

There has been a shift in the emphasis on root causes of accidents and consequently what can be done to improve safety and reliability (7-9). In the past, high reliability industries concentrated on mechanical failure to improve safety. However, during the 1980s, the emphasis tended to shift from blaming the equipment to blaming individuals for accidents and mistakes considering human error to be the greatest cause of accidents.

Today, safety improvement experts are focusing on Human Factor (HF) and how people interact with complex systems and cultural issues (8-12). The healthcare industry is beginning to discuss often hidden or ignored system problems (13). Secondary benefits of an HF approach are improved morale and enhanced workplace efficiency. Operating room safety is an interdependent process carried out by teams of individuals with advanced skills training in different roles. The use of checklists and briefings must be an integral part of any dialysis access invasive procedure (14, 15). Debriefing after a procedure

is a uniquely effective safety improvement tool, where the lead operator conducts a discussion of problems encountered, and also reinforces excellent team performance.

DIALYSIS ACCESS SIMULATION

Dialysis access simulation improves safety and introduces new techniques to the physician responsible for providing dialysis access. Unfortunately, operating room teams rarely engage in simulation training. Dialysis access simulators can range from simple anastomosis suturing technique learning devices, to a pulsatile dialysis access surgical arm simulator and tunneled graft conduit systems for central vein catheter insertion and cannulation of the dialysis access, to computer-designed simulators to teach interventional procedures (15, 16). Communication and social leadership skills training can also be accomplished in the simulation setting (15, 17, 18). The simulation-supervised training modality can improve education and safety, especially when implementing new technology. Communication skills and situational self-appraisal can also be measured and assessed in a simulation setting (19).

The Mission of the "Training and Certification" program is to minimize the knowledge and skills gap in dialysis access. Specifically, the key components for safety and improved outcome are the proper selection of the dialysis modality; type of access; surgical tools; sites; the timing of the access placement; and when to maintain, salvage, or abandon the access. Successful implementation will decrease inconsistencies and professional bias in outcome by improving access function and patient longevity. An example of professional bias is that access surgeons may not perform or be trained to place PD catheters, thereby excluding a significant patient cohort from a most desirable first time dialysis mode of renal replacement therapy (RRT). Even some nephrology fellowship programs do not offer adequate PD training.

Patients are the immediate and most affected stakeholder. The healthcare system will benefit from better outcome and perhaps cost savings through efficiency and the wise selection of dialysis access procedures from available resources and technology. Hospitals and physicians will benefit from improved outcome by meeting mandated dialysis access outcome goals and criteria. Certification will bring value to the trained stakeholder, as it assures a level of documented competence.

THE DIALYSIS ACCESS HUMAN FACTORS BASED TEAM TRAINING CONCEPT

The components constituting the education and training in dialysis access are summarized in Table I. Team members must have *knowledge* about dialysis access from formal medical study material and postgraduate training prior to engaging in the *skills* training using simulator techniques as well as surgery under supervision. Workplace safety comes from skills and experience. Skills can be improved by incorporating simulation as part of skills training (15, 18). There is no substitute for knowledge and skills to achieve safety, reliability, and outcome effectiveness. The *HF* concept incorporates many things related to human nature in systems, such as the willingness to work, interpersonal skills, behavior, and drive (7-13, 16, 17). Communication that is clear, concise, and timely is a major component in workplace effectiveness and safety. The philosophy of this training approach also includes the concept of educating the trainee to a commitment of training other new team members coming into the dialysis access field. After completion of training and successful completion of a written and oral examination, a *certification* document is issued.

TABLE I - SUMMARY COMPONENTS OF THE TRAINING AND CERTIFICATION IN VASCULAR ACCESS

1. **Knowledge:** "What, when and why to do," schooling, reading material, Continuing Medical Education (CME) activities.
2. **Skill:** "How to do," simulation, experience, fellowships, hands-on training.
3. **Human Factor:** "Wanting to do," attitude, communication skills, coping with regulations, human–system interaction, situation awareness, social intelligence, root cause analysis
4. **Testing:** Written and oral (For details see Appendix Tabs. I-III, available online at www.vascular-access.info)
5. **Certification:** Tier-leveled issuance of training and level of dialysis access competence.

A CUSTOMIZED (TIERED) DIALYSIS ACCESS TRAINING

As there are no standards for a dialysis access training curriculum, the authors propose a three-tiered or customized approach. As dialysis access professionals may have significant variation in knowledge and skill levels, training must be designed to meet individual and institutional needs. The tier level will be decided from an application form and trainee interview.

A trial (mock) training program and examination was tested with five experienced dialysis access surgeons. After training, a core written multiple choice examinations consisting of 100 questions was given. A few examples of such questions is provided in Appendix Tab. I, available online at www.vascular-access.info. The examination included 20 questions requiring judgment of simulated clinical scenarios (Appendix Tab. II). An oral examination follows with five scripted questions addressing preoperative planning and specific access options along with management of common issues encountered in practice, such as

the ischemic hand and access aneurysms. Also, the oral examination included 100 power-point slides of x-ray, ultrasound, and dialysis access anatomy images, testing the ability to make correct clinical decision in dialysis access patient care with a time constraint on information processing and decision-making (Appendix Tab. III). The evaluation from this pilot program training is being applied to enhance future training delivery and experience.

A *tier 1* training curriculum would be needed for a surgeon or nephrologist who has minimal or no dialysis access experience, coming from a residency or a vascular fellowship program. This would entail up to 4 weeks of vascular access hands-on skills training or approximately 200 operating room procedures.

Tier 2 training is primarily designed for the interventional specialist needing additional in-depth experience. Surgeons with limited dialysis access experience may benefit of exposure to new techniques and HF training. This is expected to take 1-2 weeks of on-site simulation and operating training including all open and endovascular dialysis access procedures. It is expected that the trainee will be exposed to 80-100 dialysis access open and/or endovascular procedures.

Tier 3 is best described as the total access surgeon who will be expected to have the skills and knowledge about all access procedures, including PD, and to be able to diagnose and correctly manage all common dialysis access complications and failures. The total access surgeon will also be expected to master endovascular procedures including composite open revisions and percutaneous procedures, such as central vein balloon angioplasty, access thrombectomy, and sutureless anastomoses. The Tier 3 training entails 2.5 days of simulation training and operating room skills training under instructor supervision. This course is designed for surgeons currently performing all types of access surgery, but who want an update of operative techniques and new developing technology and HF.

Each tier-training model includes required reading material and power point delivered evidence-based decision-making tutorials in selecting the appropriate mode of dialysis and type of access and surgical sites.

TESTING AND EXAMINATION

After completing customized education and training course, rigorously designed and validated written and oral examinations will follow to ensure competency (Appendix Tabs. I-III, available online at www.vascular-access.info). A written, basic knowledge, multiple choice test of 100 randomly selected questions from a large pool will assess basic knowledge (Appendix Tab. I). A second set of 20 questions (Appendix Tab. II) will assess the trainee's judgment ability in choosing the best access algorithm of a given patient at a given time. Ten oral questions to test judgment have been scripted. Also, an audio-visual oral examination (Appendix Tab. III) will assess the trainee's ability to rapidly make decision from time-limited exposure to 100 power point slides showing pictorial representation of surgical anatomy, radiographic, or ultrasound imaging studies. The learner will also be tested to assess knowledge about modes of dialysis access failure specifically inflow, outflow, and conduit-related issues.

CERTIFICATION

After completion of the education and training and final examination, a certificate specifying the individual's competencies will be issued.

Continuing Medical Education (CME) accreditation will be offered for time spent in training, including time spent on reading material, didactic lectures, simulation, and hands-on training in the operating room, and using simulators. Training and examination will result in issuing CME credit but does not guarantee a certification. Only when all components of knowledge, skills, and passing testing scores are satisfactorily completed, a certification diploma will be issued on the basis of criteria. The certification will reflect the procedures certified. For example, a (Tier 3) total access surgeon is certified to do all open and interventional procedures as well as diagnosing and managing all complications. A nephrologist may be certified only for interventional procedures (Tier 2), while a surgeon out of residency (Tier 1) may only be certified for limited open and interventional dialysis access procedures. As experience is gained, trainees may return for advanced (Tier 3) training, testing, and certification.

For the dialysis access training program to be successful, broad-based support has been secured by *key opinion leaders* in the dialysis access field. The Training testing and Certification of Dialysis Access is guided by a 15-member advisory board appointed from the dialysis access community. The dialysis access training and certification program is a beginning in an all-inclusive developing and refining process with widespread support from dialysis access surgical, nephrology, and radiology leaders in the United States and abroad. The training and certification brings a degree of legitimacy and needed standardization to the dialysis access. Subsequently, it should also give trained individuals confidence in performing and selecting the appropriate treatment in the increasingly complicated access case selection requiring critical algorithmic judgment.

FACILITY

Currently, the training curriculum is delivered at a new integrated Hospital-associated dialysis access outpatient facility equipped with state-of-the-art technical support

Fig. 1 - *Image of one of six procedure suites equipped with live video streaming capabilities, digital radiology, and hemodynamic monitoring. The facility has 6 pre-op stations and post-op stations, stage II recovery room and an extended recovery area, spacious waiting room, covered canopy for both the patient drop off, and ambulance entrances. A large video conference room can be converted to a 7-station simulation training space.*

(Fig. 1). Features include pre and post-surgery beds and six operating suites, two of which have live video streaming capabilities. Each operating room has digital radiology equipment and hemodynamic monitors. A large video conferencing room is available and equipped with high definition TV monitors and cameras for teaching and live streaming capabilities via Internet to to anywhere in the world. An adjacent conference lecture room can be converted to a simulation training area with seven stations.

SUMMARY

Dialysis access care is multidisciplinary, complex, poorly coordinated, and fragmented in nature with a large economic burden for the healthcare system. Until effective preventive measures can be instituted, teaching those involved in ESRD treatment should result in better outcomes and quality of life. Training will eliminate gaps in knowledge, technical skills, and delivered in a tiered fashion to meet individual needs. Knowledge, skills, and an appropriate attitude are the mainstays for a successful dialysis access program curriculum and at the core of the HF training philosophy. Much of skills can be learned in the simulation environment before exposing patients to procedures. A dialysis access safety workplace culture implies accountability that is balanced to recognize the human contribution to success or failure in the complex ESRD and dialysis access systems.

Financial support: The authors have no financial disclosures to make.

Conflict of interest: The authors have no conflict of interest.

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