Developing and maintaining competency with circulatory assist devices: how to meet the challenge

Heart failure is the only cardiovascular disease that is increasing in prevalence in developing countries. As a result, circulatory assist devices are being used more both as a bridge to heart transplantation and as destination therapy in patients with a failing heart. Nurses must become knowledgeable about these options for their patients. Developing and maintaining competency can be challenging as more devices become available. The principles of adult learners were used by one academic medical center to set up a new circulatory assist program and to maintain ongoing competency among staff working with patients who have these devices. (*Progress in Transplantation.* 2010;20:125-128)

Laura Savage, RN, MSN, PCCN, Jennifer Murphey, RN, Kenna Joyce, RN, BSN, PCCN
Virginia Commonwealth University Health System, Richmond, Virginia (LS, KJ), Veterans Affairs Medical Center, Richmond, Virginia (JM)

Corresponding author: Laura Savage, RN, MSN, PCCN, Virginia Commonwealth University Health System, 7098 Old Millstone Drive, Mechanicsville, VA 23111
(e-mail: lsavage@mcvh-vcu.edu)

Heart failure is a major public health problem in the United States.[1] It is also the only cardiovascular disease that is increasing in prevalence in developing countries. Moreover, with the aging population, clinicians will see an increasing number of patients with heart failure in a variety of settings. As new drugs are approved for therapy, the outlook for patients with heart failure is improving. However, mortality remains high, with more than 50% of patients dying within 5 years of their initial diagnosis.[2] Circulatory assist devices are increasingly being used to help patients with a failing heart. Nurses must become knowledgeable about the options for their patients. Maintaining competency can be challenging as more devices become available. In this article, we discuss one center's strategy for ensuring ongoing competency with circulatory assist devices.

In a large academic medical center, it is not unusual to have multiple devices to manage a failing heart. Currently, in our facility, 5 devices are used to assist compromised myocardium. These include the intra-aortic balloon pump and 4 different temporary left and/or right assist devices: Abiomed (Danvers, Massachusetts), Thoratec HeartMate I (Thoratec, Pleasanton, California), Syncardia Total Artificial Heart (TAH-t; Syncardia, Tucson, Arizona), and most recently, the Jarvik 2000 (Jarvik Heart Inc, New York, New York). It is anticipated that even more devices will be added in the future; therefore, it was necessary to establish strategies for developing and maintaining staff competency with these devices. In this article, we discuss strategies used in the progressive care unit to develop clinical expertise and to promote ongoing competency with the TAH-t and the Jarvik 2000.

Preparing Staff for a Total Artificial Heart Program

Malcolm Knowles was one of the first to propose that adult learners differ from child learners.[3] He acknowledged that adults learn best when information can be related to "real-life situations." When designing the program, specific characteristics of adult learners must be considered. Adults tend to be "results oriented."[4]

If the plan does not fit with their goals, they will often opt out of the experience. In addition, adult learners may be skeptical of new procedures and decide to "try it out" before accepting it as part of the routine. In addition, nurses are a diverse population. As Strauss and Howe[5] noted, specific learning traits are associated with learners across the generations. These differences should be considered when a new training program is being developed. Moreover, models of learning, such as Fleming's VARK model,[6] help to elucidate methods for teaching new concepts by using the senses to promote understanding.

Once it was decided to embark on the journey to bring the TAH-t program to our hospital, it became necessary to develop a training plan for the nursing staff. A team consisting of cardiothoracic surgeons, the ventricular assist device coordinator, and the clinical nurse specialists for the cardiac surgery intensive care unit and the cardiac surgery progressive care unit (CSPCU) was sent to University Medical Center-Arizona for the initial phase of training. There, several days were spent learning all the intricate aspects of the TAH-t. Once the trip to University Medical Center-Arizona was completed, the team came back and developed a plan to train the staff. Recognizing that adult learners have short attention spans and learn best by using a variety of strategies, we developed a plan that took into consideration generational differences as well as different learning styles. Much of the care of TAH-t patients involved technology and equipment, so we recognized that providing both cognitive and hands-on learning would be important to enable staff to grasp the necessary concepts.

It was decided to educate all staff about the new device, but to recruit seasoned staff as the "specialty nurses." Acknowledging the attributes of the experienced nurses helped to get those nurses to buy in to the program and validated their worth. Those nurses would be the initial caregivers and serve as preceptors to future staff caring for patients with a TAH-t.

The clinicians presented an overview on the TAH-t to all of the nurses. The specialty nurses attended a special class that was presented by nurses from University Medical Center-Arizona and Syncardia representatives. The first part of the class was presented by the nurses from Arizona. It was focused on daily and emergency management of patients with a TAH-t. We went over the TAH-t, how the nurses from Arizona implemented the program, procedures for caring for the device, and the anticoagulation management of patients with the device. Training began with "hands-on" experience. The nurses learned how the device fit together and the construction of the device. Next, they were educated on protocols for care of patients with a TAH-t, including drive line care, specifics related to obtaining blood samples, managing intravenous catheters, documentation of key parameters, and how to interpret waveforms. Last, and perhaps most importantly, time was spent gaining hands-on experience with the console. Nurses reviewed the computer and the simulator. They practiced turning the drivers on and off, dialing in the settings, changing from one driver to the other, and changing the primary and reserve air tanks. The classroom content was presented in 4-hour blocks of time. The informal atmosphere allowed for questions and ample time to "touch" the equipment.

After the specialty nurses had demonstrated skill with the equipment, scenarios were presented to stimulate critical thinking and problem solving. In keeping with the methods of the Kolb Learning Style Inventory,[7] the simulator was used for common scenarios to help the specialists to anticipate potential problems. In this way, staff could anticipate interventions to take before the TAH-t was attached to an actual patient. This style helped to increase the learners' comfort and competence with the new therapy. It also helped to solidify all of the didactic content. In addition, the nurses observed "experts" changing consoles and air tanks before the nurses had hands-on practice with the equipment. The Learning Style Inventory describes learners who are "convergers" (ie, problem solvers), "divergers" (who prefer to observe rather than actually get hands-on experience), and "accommodators" (who are more intuitive and prefer to learn through active participation).[7] All of these concepts must be considered for effective learning.

Before the first implant, the clinical nurse specialist developed a resource manual. This book contained written protocols for care. It gave examples of normal and abnormal waveforms. In addition, step-by-step instructions for obtaining samples for specialty laboratory tests including thromboelastography and platelet aggregometry were defined. Other content included the procedure for changing out air tanks, emergency contact information for physicians, and how to obtain support from biomedical engineering and pharmacy personnel.

After the first artificial heart was implanted, the nurses from the CSPCU spent a 4-hour block in the intensive care unit to refamiliarize themselves with the console. This training experience was organized by the clinical nurse specialist. When a patient came to the floor, he/she was initially assigned 2 nurses. The team consisted of a specialty nurse and another staff nurse. The 2 nurses worked side by side for the 12-hour shift. The first 4 hours was a team effort, during which the console/drivers, the console computer, the air tanks, and the drive line care were reviewed. The focus was on daily and emergency management of the device. The clinical nurse specialist worked with each group to provide additional support. Each

Topic	Reviewed (date)	Demonstrated (date)	Date/Signature/Method S = simulated C = cognitive D = demo
1. TAH-t/LVAD implant A. Preoperative teaching B. Equipment required i. What to take to operating room ii. Backup required iii. How to obtain additional equipment C. Set up PBU/system monitor			
2. Patient care A. Site care B. System check/data card C. Batteries D. Hand pumping E. Documentation F. Obtaining samples for special laboratory tests - TAH-t			
3. Troubleshooting A. Low-flow states (causes and actions) B. Changing system controller C. Alarms D. Yellow wrench E. Red heart F. Defibrillation/cardioversion G. Air tanks			
4. Discharge planning - LVAD 5. Diversional activities - LVAD/TAH-t			
6. Resources A. Syncardia B. VAD coordinators C. Heartline 24/7			

Figure Suggested skill check-off list for circulatory assist devices.

Abbreviations: LVAD, left ventricular assist device; PBU, power base unit; TAH-t, Total Artificial Heart by Syncardia (Tucson, Arizona); VAD, ventricular assist device.

nurse checked off on the elements needed to care for the TAH-t (see Figure).

As the other nurse became more comfortable caring for the patient, the specialty nurse slowly stepped back to allow the staff nurse greater responsibility for the patient. This procedure continued for several weeks until the CSPCU nurses felt that they were capable of managing all aspects of care for patients with a TAH-t. In addition, one of the "trainers" would stop in every shift to evaluate the comfort of the assigned nurse. This level of support served to provide reassurance to the patient as well as to the staff nurse.

In addition to the TAH-t, the CSPCU handles patients who have a left ventricular assist device. A similar model was used to train staff initially; however, the greater challenge is maintaining competency on the various devices. As previously stated, the unit educator relies on the specialty team to provide care to patients with these devices. As nurses become proficient in routine care, staff is selected to train on the devices. In this academic medical center, nurses must demonstrate "competency" as evidenced by criteria from the professional advancement program, known as the "ladder." Competency is generally gained between 18 months and 2 years of practice. Specialty nurses serve as preceptors to new nurses who demonstrate readiness to take on these patients. They must demonstrate critical thinking skills as well as effective time management.

Maintaining Staff Competencies

Much thought and planning went into developing the plan to maintain competencies of staff providing care to patients with a mechanical assist device. Rushing to train staff while not taking the time to select the most appropriate teaching techniques can have adverse effects on the implementation of new technology in the workplace.[8] Research has shown that accommodating learning styles improves achievement of the desired goals.[9] Most of the nurses felt more comfortable with a hands-on approach to learning, especially when new technology is involved. In some cases, many months will pass without the opportunity to care for a patient

with a mechanical assist device, making it even more important to provide adequate support for staff.

To ensure ongoing competency, the unit educator provides hands-on education to existing staff in several ways. Again, being cognizant of the variety of learners and their learning styles, care of patients with a circulatory assist device is integrated into the annual skills fair. Patient scenarios are given to review critical thinking. Each nurse is required to demonstrate emergency management for each device. A checklist is used to ensure consistency. Specialty nurses teach this content under the direction of the clinical nurse specialist.

Fleming's VARK model[6] validates the strategies used for the skills fair. VARK describes the importance of using visual, auditory, and kinesthetic approaches to learning. Competency training for the TAH-t involves use of the simulator. Use of the simulator allows nurses not only the opportunity for hands-on training with the device, but also an opportunity to see the heart at work. The simulator shows nurses the heart pumping just as it would appear when implanted into an actual patient. Virtual practice environments provide nursing staff with the chance to practice critical technical and assessment skills before caring for a patient with this new device.[10] Clinical simulation provides interaction and a certain degree of realism for learners.[11] We have found that using the TAH-t simulator enables nurses to maintain a comfort level when caring for patients with a mechanical assist device. The simulator allows them to practice and refine their skills in the absence of a "real" patient.

When preparing for a new TAH-t or left ventricular assist device, nurses are given the opportunity to review the mechanics of the device by using a simulator and the backup console. In addition, they may choose to spend 4 hours with a nurse from the intensive care unit to care for the patient who has the device. The clinical nurse specialist develops a schedule of care for the patient to ensure both consistency of caregivers and competency of staff. Specialty nurses are scheduled to be available for support to the "novice" device nurse. The clinical nurse specialist also provides support to nursing staff. These patients are challenging, but extremely rewarding. Therefore, the goal is to have every nurse proficient in the care of patients with a total artificial heart and patients with left ventricular assist devices.

Conclusions

As research brings forth new technologies, nurses will continue to face challenges. A well-designed education program that takes into account adult learning styles and strategies as well as generational differences will serve to ease the transition to any new program. In this case, these educational principles were applied to the mechanical circulatory assist program, specifically, the implementation of the TAH-t. The result was the development of staff who became confident and competent in the care of patients with a total artificial heart. The rewards to staff as they grew in their clinical practice were great. Overall staff satisfaction was high as they were challenged to take on this new population. Specialty nurses continue to serve as mentors to novice nurses. They teach device care during the annual skills fair. New staff members look forward to their opportunity to care for these complex patients in a supportive environment. Ultimately, our patients are the beneficiaries of professional, competent nursing care.

Financial Disclosures

None reported.

References

1. Amin A. Hospitalized patients with acute decompensated heart failure: recognition, risk stratification and treatment review. *J Hosp Med.* 2008;3(6 suppl):S16-S24.
2. Podesser BK, Bauer M, Liao R. Evolving cell-based therapies for heart failure patients. *Curr Treat Options Cardiovasc Med.* 2008;10(4):358-367.
3. Eshelman KY. Adapting teaching styles to accommodate learning preferences for effective hospital development. *Prog Transplant.* 2008;18(4):297-300.
4. Knowles M, Holton E, Swanson R. *The Adult Learner.* 6th ed. Burlington, MA: Elsevier; 2005.
5. Characteristics of Adult Learners. http://online.rit.edu/faculty/teaching_strategies/adult_learners.cfm. Accessed June 10, 2009.
6. Fleming ND. VARK, A Guide to Learning Styles. http://vark-learn.com/english/index.asp. Accessed June 10, 2009.
7. Contessa J, Ciardiello KA, Perlman, S. Surgery resident learning styles and academic achievement. *Curr Surg.* 2005; 62:(3)344-347.
8. Di Bartola LM. The learning style inventory challenge: teaching about teaching by learning about learning. *J Allied Health.* 2006;35(4):238-245.
9. Mellis CM. Optimizing training: what clinicians have to offer and how to deliver it. *Pediatr Respir Rev.* 2008;9(2):105-113.
10. Casey SL. Learning styles in the adult arena: an update. *J Ala Acad Sci.* 2000;1(1):178. http://findarticles.com/p/articles/mi_hb178/is_2000_Jan-April/ai_n28813064. Accessed June 28, 2009.
11. Jeffries PR. Designing simulations for nursing education. In: Oermann M, Heinrichs K, eds. *Annual Review of Nursing Education.* New York, NY: Springer Publishing; 2005.