The American College of Cardiology and the American Heart Association have established national guidelines for treating ST-elevation myocardial infarction (STEMI) patients, the primary focus of which is to improve the care of the STEMI patient. The 2007 STEMI Focused Update states the following as a class 1 recommendation:

1. STEMI patients presenting to a hospital with percutaneous coronary intervention (PCI) capability should be treated with primary PCI within 90 minutes of first medical contact.

2. STEMI patients presenting to a hospital without PCI capability, who cannot be transferred to a PCI center and undergo PCI within 90 minutes of first medical contact, should be treated with fibrinolytic therapy within 30 minutes of hospital presentation unless contraindicated.

Such goals involve teamwork and a positive collaboration among three components of the healthcare team: the emergency medical system, emergency department, and cardiac catheterization laboratory. Additionally, the Centers of Medicare and Medicaid Services, the Joint Commission on the Accreditation of Healthcare Organizations, and other regulatory agencies are including door-to-balloon (D2B) time as a core measure of quality care in STEMI.

MEDICAL SIMULATION

Simulation education provides a comprehensive experience through which healthcare teams are immersed in realistic, clinically relevant patient-care scenarios. The role of simulation education allows for teaching and assessment of clinical skills, including physical examinations, first-responder actions, critical thinking skills, and teamwork in a controlled, safe environment without endangering patients. In addition, various clinical scenarios can be simulated in which realistic patient outcomes are programmed and treatment options can be delivered. Repetition of scenarios is possible, and uncommon encounters can be experienced and practiced in a uniform manner with all members of the healthcare team. Immediate feedback is available and can facilitate a discussion of alternate treatment options, near misses, errors, and process refinement in order to improve...

Reducing Door-to-Balloon Times With Medical Simulation

Medical simulation is well suited to educate care teams in reducing door-to-balloon times.

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Figure 1. Patient simulator demonstrating the catheterization lab environment.
patient care. This type of environment allows participants to “learn by doing” (without patient risk), which is associated with increased learning achievement and retention of knowledge. Current literature shows curriculum that includes medical simulation can improve performance and adequately engage learners. Research also suggests improved efficacy of simulation-based training compared with traditional methods alone.

Medical simulation training has been utilized for years in fields outside of medicine—aerospace and military applications have aided in skill training and assessment. The acceptance of simulated training in the medical field is growing; surgical simulators have demonstrated enhanced training of general and vascular surgeons. Medical simulation training is currently being used in the field of cardiovascular medicine to help educate physicians on new technologies, and training programs are in place to help improve care in hospitals related to national quality initiatives. In addition, the American Board of Internal Medicine has included interventional cardiology simulations developed by Medical Simulation Corporation (Denver, CO) as part of their Maintenance of Certification program for interventional cardiology.

**MEDICAL SIMULATION AND THE STEMI PATIENT**

When delivering high-level STEMI care, evidence-based quality of care relies on the competency of individuals delivering the care and the processes that support their goals. A challenge for any hospital-based care program is process development, implementation of the program, and the subsequent delivery of the highest level of care. With the proliferation of many smaller, lower-volume hospitals performing acute PCI for STEMI patients, training, guideline and core measure compliance, and application of recent clinical trial data in the field of acute myocardial infarction training are even more critical.

For STEMI patients, there are many treatment variables that have an impact on the D2B time. The objective for the treatment of the STEMI patient is to reduce the total ischemic time (acute myocardial symptom onset to treatment time). Medical simulators have the ability to identify areas of possible delay and better help first responders and hospital-based care teams (including emergency room physicians and the interventional cardiologist) minimize delays.

Human patient simulators can be programmed with specific heart and lung sounds that can be auscultated. The simulator mannequin, facilitated by an educator, can verbally respond to questions, elicit palpable pulses, react to pharmacologic and other treatments, and generate blood pressure, electrocardiogram (EKG), and oxygen saturation readings. In addition, lab values, x-rays, 12-lead EKGs, and other ancillary examinations can be viewed, diagnosed, and, in turn, guide treatment choices (Figure 1). These robust features provide participants with a clinically relevant and challenging encounter. The focus becomes a learner-centered educational experience in which improved recognition of disease processes and management of patients can be achieved.

The simulation software incorporates a comprehensive haptics program, which emulates catheter-based behavior as actual device hardware is used during the simulation. Key components include the education and training of the cardiac catheterization laboratory team, with the ultimate goal of preparedness for their role in optimization of D2B times via programmed algorithms. Teamwork and the process of reliable communication patterns can be developed; patient assessment, equipment preparation, pharmacologic delivery, as well as exposure to adverse events possible during a PCI, can be repeatedly practiced.

The educational approach surrounding the D2B time initiative was evaluated at the 2008 SCAI/ACC annual meeting. Multiple simulation platforms were incorporated to present a simulated STEMI patient from the onset of symptoms through the emergency medical system and emergency department process of care. Using the Laerdal SimMan (Laerdal Medical Corporation, Wappingers Falls, NY), a human patient simulator, a scenario that encompassed both patient care and process issues was generated (Figure 2). Starting with a 911 dispatch call in which the patient described his symptoms as being consistent with a cardiac event, the scenario involved all facets that are imperative to those involved in reducing D2B times.
Educators can design simple to advanced scenarios in which multiple physiologic algorithms can be adjusted based on participant actions or predefined parameters. The mannequin has a library of heart, lung, and bowel sounds, and blood pressure can be palpated, auscultated, or taken automatically. In addition to the preprogrammed library of vocal responses, the software allows specific vocal prompts to be recorded to personalize the scenarios of each patient. The simulated patient care monitor can be loaded with a variety of real diagnostic images, such as 12-lead EKGs, x-rays, and other ancillary information. Debriefing with the SimMan software is seamless; the event log is synchronized with a video camera that records both audio and video interaction during the educational sessions.

CONCLUSION

Medical simulation provides an opportunity to deliver education that encompasses all personnel needed for improving D2B times. Given the multidisciplinary team training required for the care of the STEMI patient and the emphasis in reducing D2B times, medical simulation is well suited to help with this process. ■

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