MITIE – AN EDUCATIONAL HOME FOR HEALTH CARE PROFESSIONALS

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On a Thursday morning in January, a middle-aged man named Stan was brought by ambulance to the emergency room of The Methodist Hospital in Houston, Texas with chest pain and shortness of breath. The ER staff moved quickly to diagnose his heart attack and begin his resuscitation. He was transferred to the cardiac catheterization laboratory for emergency angioplasty and stenting. During the procedure, Stan developed ventricular tachycardia and required rapid defibrillation. He went on to have a stent placed successfully and was stabilized. Interestingly, after the procedure Stan was "powered down" and transferred back to his virtual hospital home. Meanwhile, the ER and cardiology teams debriefed about their performance in resuscitating him and recorded their "door-to-balloon time."

It turns out that "Stan" is a completely portable human patient simulator called i-Stan (Figure 1). He blinks, breathes, talks and responds to injected medications. He can simulate a variety of medical conditions such as a myocardial infarction, cardiac dysrhythmia, and respiratory failure, and can be resuscitated by endotracheal intubation, placing IV lines, drawing "blood" samples, administering medications, and defibrillation. i-Stan is used to simulate high-risk events so that medical teams can rehearse their resuscitation efforts under the watchful eye of a scenario director who records each team member's performance and monitors i-Stan's response. After completing a scenario, the team assembles for a debriefing session and video recording of the event is reviewed along with i-Stan's physiologic parameters. Team performance can be compared to a benchmark, such as "door-to-balloon time" in this scenario — an accepted measure of a hospital system's proficiency in the care of myocardial infarction patients.

In 2007, Gerald Lawrie, M.D., an expert heart surgeon at The Methodist Hospital, wanted to begin performing robotically assisted mitral valve repair surgery for his patients. He had traveled the world watching the handful of experts who were doing this operation and had ideas on how it could be improved. He brought his operating room team to an experimental OR on the second floor of the hospital's West Pavilion, where he worked out his approach using the same robot he has in the OR and a simulated open-heart surgery model. He practiced his technique with the entire team and measured his simulated pump times (the time required for the patient to be on the heart-lung machine to complete the valve repair), comparing them to his usual open procedures. Only when the team reached a proficiency level that resulted in pump times similar to Dr. Lawrie's open-valve repair times did they attempt their first human case. Within months, Dr. Lawrie had successfully performed more than 35 robotically assisted mitral valve repairs.

These case reports describe the type of training conducted in the new Methodist Institute for Technology, Innovation, and Education (MITIE™). MITIE is an education and research institute whose mission is to help health care professionals maintain their excellent clinical skills and acquire new ones. MITIE's focus on practicing physicians, nurses, and allied health care professionals is unique in that this group has needs and skills different from medical trainees.

MITIE has developed through the vision of Barbara Bass, M.D., chief of Surgery at The Methodist Hospital and MITIE's executive director. A nationally recognized leader in the field of surgical education, Dr. Bass has been working with the American College of Surgeons to develop a countrywide network of institutes that serve as "educational

Figure 1. i-Stan is a completely portable human patient simulator.

Figure 2. Two physicians work on "Samantha" in a simulated endovascular suite.

Figure 3a. The procedural training lab in MITIE.

Figure 3b. Dr. Dunkin teaching a new endoscopic procedure in MITIE.

homes" for physicians who want to retool their skills throughout their career. In 2007, she recruited Brian Dunkin, M.D., to serve as the medical director for MITIE and help bring her vision to life. An expert in minimally invasive surgery, Dr. Dunkin has a background in biomedical engineering and extensive experience in medical simulation and surgical skills training.

MITIE is developing in two stages. The first is housed on the second floor of the hospital's West Pavilion utilizing renovated clinical OR and recovery room space. This 17,000-square-foot facility is comprised of three components. The first is a virtual hospital, where any part of the patient care environment can be recreated using simulation technology. i-Stan lives in the virtual hospital, but because he is completely self contained, he can be brought into the real hospital environment for "in-vivo" training as described above. The virtual hospital contains other technology as well, including an endovascular simulator for performing advanced diagnostic and therapeutic procedures, airway simulators, laparoscopic surgery simulators, and even IV insertion simulators (Figure 2). Nurses and doctors come together in this environment to rehearse the management of low-frequency, high-risk events like heart attack or hemorrhagic shock or to perform procedures such as coronary artery stenting, laparoscopic surgery, or ultrasound-guided central line insertion. The second component of MITIE is a procedural skills laboratory (Figure 3a, b). Here, multiple mini operating rooms and/or gastroenterology suites provide for hands-on procedural training. Physicians learn how to perform new techniques and use new technology by rehearsing procedures using sophisticated simulation models. There are also two

robotic surgery operating rooms for training on this advanced platform and a microsurgery training lab. MITIE's third component is a core of research operating rooms for developing new technology and advancing image-guided procedures (Figure 4).

The MITIE project also includes an Inanimate Skills Laboratory (ISL) located on the fourth floor of the Fondren building (Figure 5a, b). This laboratory provides a home for residents and fellows to practice their procedural skills. Thirty-three separate skills modules have been developed for the ISL, starting with basic suturing and knot tying and progressing to therapeutic flexible endoscopy and advanced laparoscopic surgery. Residents and fellows are given 24-hour access to the facility so they can practice their skills independently. During their five years of training at Methodist, every general surgery resident must demonstrate proficiency in each of the 33 modules in order to progress.

The second stage of MITIE's development will be completed by the summer of 2010, when the facility will relocate to the fifth floor of The Methodist Hospital Research Institute (TMHRI). The three core components will be preserved in the new facility, but capacity will expand to more than 35,000 square feet (Figure 6a, b, c). The scope of education and research initiatives in TMHRI MITIE and the size and sophistication of the facility will be unparalleled in the world.

MITIE began its educational mission in November 2006 with instruction in robotic surgery and rapidly became one of the busiest robot training centers in the world. Since then MITIE has evolved to provide more than robotic surgery training, with more than 1,500 physicians, nurses, and allied health care providers from around the world having attended educational

Figure 4. An experimental operating room in MITIE.

Figure 5a. Imges of the MITIE Inanimate Skills Laboratory (ISL).

Figure 5b. Imges of residents and attendings at work in the MITIE ISL.

Figure 6a. Architechtural rendering of the lobby in the TMHRI-MITIE.

Figure 6b. The procedural skills lab in the TMHRI-MITIE.

Figure 6c. The Virtual Hospital in the TMHRI-MITIE.

activities across 15 specialties. MITIE has also been instrumental in introducing new clinical procedures to Methodist. Robotically assisted mitral valve repair and colorectal surgery, radiofrequency ablation of the esophageal mucosa, per oral choledochoscopy, electrohydraulic lithotripsy, super dimension bronchoscopy, green light laser prostatectomy, laparoscopic placement of diaphragm pacing electrodes, and balloon sinuplasty have all been taught and rehearsed in MITIE prior to being introduced into clinical practice at Methodist. MITIE has also embarked on a robust nurse training program. Under the guidance of Vivian Dawkins, Ph.D., R.N., multiple simulated clinical scenarios have been developed to help Methodist nurses practice procedures and team-based care to optimize patient safety.

MITIE has developed a comprehensive research portfolio as well, with more than 14 active projects encompassing new technology development, new surgical techniques, simulation training, and metrics for skills acquisition. This work is funded by grants from the National Science Foundation, the Department of Defense, and industry. MITIE has also formed partnerships with key industry leaders such as Karl Storz Endoscopy and Intuitive Surgical to provide innovative technology for the Institute and develop new devices and techniques that advance the field of medicine.

In June of 2008, MITIE was certified by the American College of Surgeons (ACS) as a Level I Comprehensive Education Institute. Despite its short history, the College was impressed with the scope of the MITIE project and awarded it a three-year accreditation with no interim review — an unprecedented achievement. With the ACS accreditation, MITIE joins a growing network of institutes in North America dedicated to meeting the ongoing educational needs of physicians. The ACS envisions that surgeons will one day be required to intermittently come to a place like MITIE to demonstrate proficiency in required skills for their specialty and learn new ones. To that end, MITIE seeks to establish a relationship with health care professionals both locally and across the globe to serve as their educational home throughout their career.

MITIE is just another example of how The Methodist Hospital is leading medicine. The work there enhances patient safety and fosters the development of new technology to improve lives. So the next time you are asked to care for a patient who looks a bit rubbery and introduces himself as “Stan,” do your best work — because the MITIE team is watching!