Letter from North America

SURGEONS AND SIMULATORS

When Captain Chesley 'Sully' Sullenberger safely landed US Airways Flight 1549 in the Hudson River in the middle of New York City, allowing for the rescue of all of its 150 passengers and 5 crew members in January 2009, the media proclaimed it as the 'Miracle on the Hudson'. With analysis of the voice cockpit recorder, it became clear that this landing was no miracle—but a skilful display of proficiency by the pilot, co-pilot and air traffic controllers. Their training allowed them to maintain calm, offer alternatives, and quickly make sound judgements. The fact that this entire episode happened in a few minutes underscores the high level of training that is well established in the airline industry of not only managing their plane and instrumentation, but also having practised crisis scenarios in advance.

In the past 5 years, surgical educators in the US have quoted airline industry use of simulators in training pilots and airline crews as a key element in reducing preventable errors, and strongly favoured similar training for surgical trainees before they perform procedures on patients. To underscore this fact, the cockpit voice recorder of flight 1549 has been repeatedly played in surgical education meetings to emphasize the need for achieving similar results in surgical training.

For years, the practice of medicine depended upon trainees learning their skills including competence for performing technical procedures on patients. In addition to the learning curve, the current generation of medical students and surgical trainees are challenged by the rapid proliferation of medical knowledge and technological advances in interventional techniques. Although the Accreditation Council for Graduate Medical Education (ACGME) and Liaison Committee for Medical Education (LCME) have increased the curricular mandates to medical schools and residency training programmes, resident and medical student work hour limits make further increases in training impractical.

Simulators are intended to place trainees in life-like situations that provide immediate feedback about questions, decisions and actions. The educational benefit of simulators is well documented in the training of pilots and astronauts, in war games and training exercises for soldiers, in management scenarios for business executives, and in technical operations for nuclear power plant personnel. Although the use of simulation technology is well established in disciplines other than medicine, it is only now gaining wider acceptance in medical training.

Medical simulator programmes are expanding in medical school and residency programmes in the US—particularly in procedurally intense and acute care specialties such as critical care, medicine, surgery, anaesthesiology and emergency medicine. In addition to 'partial task trainers' aimed at achieving mastery of skills such as placement of a central venous line, advanced medical simulators include virtual reality trainers for laparoscopic surgery and endoscopy, and high-fidelity mannequins to simulate patients in critical care, emergency room, trauma and mass casualty situations. Acute care management has benefited from high-fidelity full-body mannequin robots that can 'breathe', 'talk' and respond physiologically like patients. These robots can be linked to physiological monitors such as electrocardiograms, central venous monitors, pulse oximetry and plethysmography, and can mimic almost any clinical scenario. Indeed, the same clinical scenario can be used to teach different levels of trainees (i.e. physiology to junior medical students, diagnosis and basic treatments to senior medical students, advanced cardiac life support protocols [ACLS] and code management to residents and house physicians).

In surgery, state-of-the-art laparoscopic trainers with haptic feedback offer training scenarios ranging from simple tasks such as manipulating blocks, laparoscopic knot-tying, to basic procedures such as laparoscopic cholecystectomy and advanced procedures such as laparoscopic Roux-en-Y gastric bypass. In addition to laparoscopic virtual-reality trainers, advanced medical simulators exist for colonoscopy, urological procedures, interventional radiology procedures under fluoroscopy and angiography/plasty. In the UK, the Royal College of Surgeons has recently opened a new clinical skills unit, where a range of simulation techniques is taught. In the USA, all cardiothoracic surgery trainees undergo training with simulators in a 'boot camp' once a year before starting thoracic surgical fellowship to ensure technical adequacy.

With the public demand for perfection, governmental pay-for-performance policies and minimal tolerance for medical errors, simulators will play a vital role in the future of surgical education. Already used in many medical schools and residencies to prepare trainees for certification in ACLS, licensing boards are beginning to require proficiency with simulators as parts of comprehensive educational programmes. For example, the American Board of Surgery now requires surgeons seeking board certification to successfully complete a course in the Fundamentals of Laparoscopic Surgery (FLS). FLS is a joint programme of the Society of American Gastrointestinal and Endoscopic Surgeons and the American College of Surgeons, and teaches the physiology, knowledge and technical skills required in basic laparoscopic surgery including hands-on skills training and assessment.

In addition to surgical education, simulators are poised to play a critical role in the future practice of surgery. For example, surgeons at the University of Rochester Medical Center published the use of a simulator programme before surgery, allowing physicians to 'rehearse' the entire procedure before the surgeon and patient ever set foot in the operating room. Vascular surgeons captured the patient's own data using a 64-slice CT angiography scanner and transferred it to the simulator, which then allowed the surgeon to 'operate' on the patient before surgery. Problems that may arise during surgery are discovered in a safe environment and can be planned for or avoided. Choices about various catheters and instruments can be made ahead of time, not only saving time in the operating room but also saving money and, most importantly minimizing unnecessary risks and radiation exposure to the patients. Hospitals around the USA have started to use simulators to certify surgeons for specific procedures in which they might have limited data on performance and quality. Moreover, with this technology, the abilities and deficiencies of trainees are not discovered in the operating room, but before the procedure. This enhances patient safety and surgical training without compromising either. Similar reports were published by neurosurgeons from the Queen Elizabeth II Health Sciences Centre in Halifax, UK, where with the assistance of a virtual-reality neurosurgical simulator developed by the National Research Council (NRC), surgeons removed a

patient's brain tumour. The simulator not only accurately depicts the anatomy, allowing doctors to rehearse complex brain surgeries, but also simulates the sense of the tumour's resistance as it is being removed and can even transmit the sensation of an instrument tip vibrating.

With ever-advancing medical technology and a trend towards minimally invasive procedures, simulators will surely play a critical role in bridging the gap between surgeons and technology. With this surge in the use of simulators, the medical simulator industry is projected to grow from currently a few hundred million dollars to annual market estimates worth about US$ 1.5 billion by 2012. Furthermore, with the recent news of decline in malpractice claims for simulation-trained clinicians resulting in a 35% decrease in premiums for anaesthesiologists and obstetricians, many hospitals and physician associations may advocate mandatory simulator training. In the next decade, it would not be an exaggeration to expect a patient to question their surgeon as to what was their simulator score for a particular procedure before performing the operation.

CHRISTOS COLOVOS
KEI SUZUKI
I. MICHAEL LEITMAN
PRASAD S. ADUSUMILLI
New York

Letter from Chennai

TRAFFIC HAZARDS OF CHENNAI

Chennai is to have a 'Road Accident Data Monitoring System' before long. The Tamil Nadu Road Sector Project, financed through a loan from the World Bank, will have a web-based application on which every reported accident in the city will be recorded and placed on a map. This will enable the observer to locate areas where accidents happen repeatedly, and the traffic flow pattern to be studied and reasons for the accidents to be analysed, so that long term steps can be taken to minimize such accidents. Loans, even those from the World Bank, must, I presume, be repaid some time. Common sense tells us a number of causes for accidents that are clearly recognized, but nothing is done about them. Why not fix what is already known, instead of spending time and money on finding some more problems for us to fail to fix?

In a couple of my recent letters, I mentioned the fact that Tamil Nadu has more deceased organ donors now than a year ago. Having devoted much of my working life to establishing renal transplantation in India, including the use of deceased donor organs, I should be happy. However, what makes me sad is that so many of these donors die unnecessarily, partly from their own error of not wearing crash helmets when riding two-wheelers, but largely due to the fault of our government. Many accidents occur because a two-wheeler encounters a pothole in the road, and the rider is thrown off balance and falls, sometimes injuring his head, sometimes falling in the path of a lorry and getting crushed under its wheels. Are not our government, the local municipal corporation and the people behind these organizations guilty of culpable homicide when a young person dies because of faulty maintenance of roads?

When I was a schoolboy, a road, once tarred and black topped, was supposed to last for 12 years before it needed re-laying. Technology should have advanced now. Further, in those days goods were transported through the city on bullock carts that had iron hooped wooden wheels and no springs, so the wear and tear of the road was far greater than it is today. All our carts are now on pneumatic tyres. Why then does the road, once laid, succumb to the very first rain that pounds it? Clearly, the work is substandard. I have seen tar roads in cities elsewhere that carry far more traffic than do ours, and they last several years longer in good condition. The contractors who lay our roads today apparently believe in planned obsolescence.

There has recently been some good news for Chennai-dwellers. Several Corporation councillors raised the issue during a session of the council a few days ago. The leader of the opposition pointed out the obvious: that there must be something wrong with the specifications for road laying, if the road was accepted as up to the mark and yet got pot-holed by the first rain it encountered. Following the old wisdom that the best way of shelving a problem is to refer it to a committee, the Mayor announced that he would form a committee with experts from the Indian Institute of Technology and the Anna University (Tamil Nadu's Engineering University) to look into the specifications. A retired Deputy Director of the Highways Research Station was quoted as saying: 'There is no compulsion on the part of the contractors to do a proper work in laying of road.' He felt the specifications are perfect, but there was no care in execution. I understand him perfectly. All our programmes for delivery of healthcare are excellent on paper. The only problem is that they never get done properly.

The rot on our roads does not end with the roadway. Our city has overwhelmingly more pedestrians than motorists or two-wheeler riders. Whenever the Corporation 'improves' the city roads, pedestrians get a raw deal. Every flyover has a road beside it for those motorists who do not go over the flyover, and the combined width of the flyover and this road alongside adds up to more than the original width of the road. As the traffic increases on many roads, the Corporation widens it. The extra width comes from the pedestrian walkway. What remains of the walkway cannot be used for walking anyway. Sundry hawkers spread their wares on the pavement. The High Court decreed a year ago that there should be no hoardings, and accordingly a large number of advertising hoardings were removed. Apparently this embargo does not apply to politicians. The pavements are taken over by large billboards indicating the undying love and loyalty of some minor politician for the great leader of his party, whenever any