PERFUSION EDUCATION

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Applying High Fidelity Simulation in Perfusion Education

An interview conducted by Ed Darling MS CCP
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The use of high-fidelity patient simulators is exploding across all disciplines of medical education including some perfusion education programs. This article will explore the use of simulation in perfusion education by questioning two program directors who are using patient simulators in their curriculum to compliment traditional clinical hands-on training.

How long have you used patient simulators for training perfusion students?

Jon Austin: We have used cardiopulmonary bypass simulation in perfusion education since 2001. In the March 2002 proceedings of AmSECT, we reported our early experiences with a presentation, *Transferring Air Force Flight Simulation Training Effectiveness To University-based Cardiopulmonary Bypass Simulation Training: A Model for Success*. Since that time, we have continued to refine and develop the simulation component of our curriculum.

Bruce Searles: We have used various forms of simulation like wet labs, animal CPB and disaster drills over the years and now are very excited about building upon these experiences with a new level of high fidelity simulation. For the next class of students, high fidelity simulation will be heavily emphasized in their clinical preparation.

Would you describe your simulator/simulator environment?

Jon Austin: We use a high fidelity computer based simulator developed at MWU. It is housed in large classroom/lab environment.

Bruce Searles: We have renovated a classroom to resemble an operating room complete with air, oxygen, vacuum, full hemodynamic monitoring capabilities, anesthesia machine, heart-lung machine and operating room table. To simulate the patient, we have purchased the Orpheus Perfusion Simulator (ULCO Technologies). The simulator is integrated with a mannequin.

What has been the impetus at your institution for the development of a simulator program to compliment the traditional methods of clinical training?

Jon Austin: Simulator exercises are used at MWU to augment academic and laboratory training with the goal of consolidating particular skills, increasing situation awareness, and preparing the student for practice within the team environment of an operating room. The training scenarios are based on a building block approach in which students first practice particular skills in isolation and later in context with other skills. In addition to developing procedural skills, emphasis in simulator training exercises will be placed on developing skills in patient/system monitoring, communication with other surgical team members, and situation awareness.

Bruce Searles: There are two major reasons; (1) patient standardization, and (2) standardized, objective evaluations. Both of these will help our students with repetitive practice and feedback in a realistic, but safe, environment.

What are some of the benefits of high fidelity simulation?

Jon Austin: Below are six benefits we have identified:

1. Enhance the skills of cardiovascular perfusionists, both during and after formal training.
2. Test and study the perfusionists' skills related to multiple tasks with a high fidelity computer based simulation of cardiopulmonary bypass without risk of death or injury to the patient.
3. Enable the perfusionist trainee to repeat test scenarios without the use of an animal model in a controlled environment and reduce cost of training.
4. Test and study the perfusionist trainee for crisis management such as the occurrence of massive air embolization, the need for failed membrane oxygenator replacement, or mechanical pump failure.
5. Conduct research in a controlled environment. The results of such research can be recorded for data analysis by both perfusionist clinicians and military researchers.
6. Provide publishable research results that will be a value in risk management for the patient, perfusionist, surgeon, anesthesiologist, and hospital.

Bruce Searles: A primary benefit of high fidelity simulation is that it provides a way to standardize the student's clinical experiences.

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Mr. Austin has developed more than 25 presentations, publications and a book chapter in the area of perfusion simulation. Mr. Searles has been a long time advocate for the use of integrated technologies in the classroom.

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The perfusion educator can guarantee a standard exposure of cases commensurate with the student's skill level and attenuate what has been termed "education by random opportunity". Additionally, there has been a loss of the routine case … we are seeing a shift toward urgent and higher acuity cases that make clinical instructors more reluctant to permit novice student participation. In the simulator room, we can standardize a realistic and reproducible clinical scenario and this experience can be evaluated by the use of strict objective end-points without rater bias. Additionally, more advanced students can practice complex scenarios such as oxygenator failure diagnosis and change out in a highly realistic environment.

How have you integrated high fidelity simulation into your perfusion program? What are some of the challenges?

Jon Austin: Simulation training takes place with two methods: High Fidelity Simulation (HFS) and Regular Simulation Practical (RSP). Students are exposed to simulation training in all three quarters of didactic training. Students experience simulation with some exposure to High Fidelity Simulation (HFS) and Regular Simulation Practical (RSP) in fall and spring quarters; Extensive RSP takes place in all quarters. A MWU faculty and/or staff will be available to help with simulations.

Bruce Searles: We have attached clinical simulation to each of our clinical courses through the first three semesters. Students are expected to be clinically active everyday. They are just as likely to be scheduled to do a case in the simulator room as they are in the operating room.

The challenges of simulation are getting the students to believe it. To overcome this, we set the tone early on that our simulator room is sacrosanct. Scrubs, hat, mask, standard precautions are required to enter. Creating that tone of realism is important. Another challenge is the large commitment of faculty hours that are needed to provide, run and evaluate simulation exercises. Also, simulators for perfusion programs can be expensive.

Regarding student simulated case experiences, where do you see your program going forward?

Jon Austin: Ericsson and others state that, in order for anyone to progress in skill beyond a minimal competence, they must have deliberate practice … "In contrast to play, deliberate practice is a highly structured activity, the explicit goal of which is to improve performance. Specific tasks are invented to overcome weaknesses, and performance is carefully monitored to provide cues for ways to improve it further. We claim that deliberate practice requires effort and is not inherently enjoyable. Individuals are motivated to practice because practice improves performance."

Ericsson, KA., Krampe, R., and Tesch-Römer C., The role of deliberate practice in acquisition of expert performance. *Psychological Review* 1993., 100, 363-406

Bruce Searles: We hope to build a program that gets the best of both worlds by giving students a cadre of standardized patients in their formative stages of training that will accelerate foundational skills acquisition, and thereby, prepares them to get the most from their clinical experiences in their rotations.

Do you have any other comments?

Jon Austin: In addition to being able to operate a heart-lung machine during routine cardiopulmonary bypass, perfusionists are required to react to emergency or crisis events. A crisis event is an event that is not planned that could have an undesirable outcome. Crisis events during CPB may include: oxygenator failure, air embolism, electrical/mechanical failure, circuit coagulation, line separation, drug/transfusion reaction, or loss

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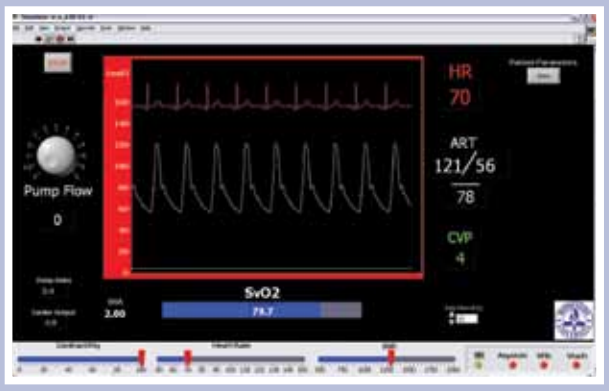

Perfusion screen shot of perfusion simulation at Midwestern University

Jon Austin with a student during a simulation

SUNY Student Ryan Holevinski and faculty Bruce Searles performing a scripted perfusion scenario

Sneak peak inside the SUNY perfusion simulator set-up

CE Self Quiz

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12. Minntech Hemocor has the smallest hemoconcentrator for pediatric patients with a prime volume of 8mL, maximum flow rate of 300cc/min and a fiber diameter of 200 microns.

a. True
b. False

13. The Performer HT by RanD biotech is designed to provide:

a. ECMO
b. intra-peritoneal hyperthermic circulation
c. regional cancer therapy
d. renal perfusion for transplant

14. Eurosets in Italy offers a new postoperative autotransfusion technique that delivers the patient's own blood back and is in a portable device called the:

a. Cardio P.A.S. Dry
b. Cleanfield
c. Goccia
d. Dry Wash

15. One of the most effective, efficient, and detailed ways to view cardiac structures for valvular diagnosis is with a transthoracic echocardiogram.

a. True
b. False

References:

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of venous return. Perfusion requires accomplishment of competencies in a critical time sequence; one may not stop the procedure to think about the next move. Similar competencies are required of aircraft pilots. Pilots are given training about how to react to events that may be considered crisis events.

The perfusion community should be developing a safety culture that includes crisis management drills. Conclusions of Ginther *et al*. indicates that while most perfusion groups place value in crisis management drills, they do not take the time to have this team training exercise. Life threatening complications during cardiopulmonary bypass are infrequent, but when these events occur, it is the responsibility of the perfusionist to react to the event with the best possible outcome for the patient. Simulation of cardiopulmonary bypass, just like simulation in the aviation industry, can reduce errors and save lives.

Bruce Searles: Jon has led the way in using simulation in perfusion education and we feel very fortunate to also be a part of this pioneering effort. While the use of simulation in perfusion training on the surface makes good intuitive sense, there is still much work to understand high fidelity simulation as an educational intervention.

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