Simulation: A Teaching Tool for Liver Transplantation Anesthesiology

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Learner Audience: Senior Anesthesiology Residents on a one-month Anesthesia for Liver Transplantation rotation.

Background: Due to an increasing number of liver transplantation centers, the number of available cases for anesthesiology residents during a time limited rotation is decreasing. Therefore residents may not be exposed to all major issues (massive blood loss, coagulopathy and hemodynamic instability) during their anesthesiology rotation for liver transplantation (ALT). Over the same period of time, patient simulation has been increasingly used for training and evaluation. There are multiple modalities available, including live patient-based simulation, task trainers, and high fidelity mannequin-based simulation.

Needs Assessment: With the decrease in orthotopic liver transplant (OLT) case numbers residents need a standardized training experience that can be provided through simulation.

Hypothesis: A simulation course in ALT will provide residents with a homogeneous clinical experience that will alleviate anxiety, improve medical knowledge, and enhance attributes outlined in the ACGME general competencies.

Curriculum Design: The ALT simulation course has two components. A pre-simulation component involves the review of self-paced on-line didactic materials pertinent to end-stage liver disease (ESLD) patients undergoing OLT. The simulation component is an interactive, four-hour training session with six sub-components: 1) A written 30-question pre-simulation course quiz, 2) Live-patient simulation of the pre-operative assessment of an ESLD patient, 3) Operating room set up, 4) Central line placement and monitoring using a task trainer, 5) High-fidelity mannequin based simulation of the intra-operative management of two scenarios: one in the pre-anhepatic stage and a second in the reperfusion stage, 6) Post-simulation course quiz.

Improvement in knowledge is evaluated using pre and post-simulation course quizzes. Impact of the ALT simulation course on residents is evaluated using a survey administered at the end of their one-month rotation.

Outcome: Twenty-four residents (n=24) completed the ALT simulation course. Residents had an average score of 75% ± 10% on the pre-simulation course quiz which increased to 92% ± 6.5% on the post-simulation course quiz ($p<0.001$) (see Figure 1).

Improvement in ACGME general competencies are difficult to measure; however, the ALT post-rotation survey showed that residents felt better prepared for their first OLT, had decreased anxiety, were able to anticipate problems, had increased awareness of the importance of communication with the transplant team, and had improved confidence (see Table 1). A common resident response was, "I wish other subspecialties had simulation courses like this."

Attribute	Statement	Score
Preparedness	Liver simulation prepared me for the first liver transplantation in the operating room.	8
Anxiety Alleviation	Liver simulation helped to decrease anxiety for providing anesthesia for liver transplantation.	6
Anticipation	Liver simulation helped me understand the problems I encountered during each phase of liver transplant surgery.	7
Communication Skills	Liver simulation helps me understand the importance of communication with different specialties involved in the surgery (blood bank, surgeons, perfusionist, CCM physician, anesthesia technicians).	7
Confidence	The liver transplant simulation helped to reinforce the educational goals of the rotation and made me feel more comfortable for future encounters .	9

Table 1: Post-rotation survey questions based on a zero to ten point scale. 0 = Strongly Disagree, 5 = Neutral, 10 = Strongly Agree. This survey is completed by residents at the end of a one-month Anesthesia for Liver Transplant rotation.
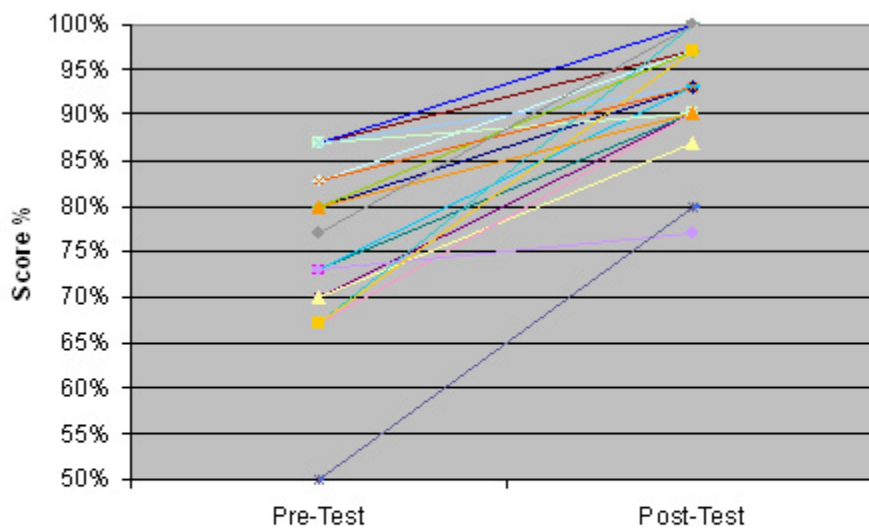

Figure 1: Percent score out of thirty questions on the pre-simulation course and post-simulation course quizzes (n = 24).