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Research Abstracts

Massive Abdominal Hemorrhage Simulator for a Crisis Management Curriculum

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Introduction: The cognitive overload experienced by surgical trainees during stressful events like massive hemorrhage can lead to a hesitated response. We describe a novel simulator designed to address skills necessary for managing such crises and outcomes from a pilot study.

Methods: Using a crisis-resource management framework, we developed a curriculum for learners to practice psychomotor technical skills, like vascular control and repair, and non-technical skills, including leadership and stress management. We designed a novel simulator replicating a large bleeding vein that can obscure the operative field with pumped artificial blood, giving trainees a realistic experience, as well as a chance to work in teams. We used ex-vivo porcine aorta for clamping and sewing practice in a 3D-printed box, and 3D-printed malleable TPU model of the retroperitoneum covered with casted silicone pieces to represent bowel. In a pilot study, the model was assessed by estimating blood loss, technical success in repair, learner performance data including objective structured assessment of technical skills (OSATS), and participant feedback. Junior residents' OSAT scores were compared to surgical fellows' scores with a t-test.

Results: Seven second-year surgery residents and 10 surgical fellows participated. One of 7 residents and 8/10 fellows completed the simulation within 20 minutes. Blood loss exceeded 300 mL in all cases. OSATS scores averaged 3.19 (SD = 0.64) per category in residents and 3.86 (SD = 0.99) in fellows ($p < 0.05$). Participants found it useful to work at a depth with real tissue. They indicated learning how to respond to bleeding, clamp blood vessels, and techniques for repair and valued practicing the skills of managing assistants and providing leadership. Residents perceived the simulation as difficult and stressful while fellows did not.

Conclusions: Our simulator provided an appropriate challenge for junior surgery residents and the superior performance of fellows provides evidence of validity.