Response to Letter

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Response to Commentary on "A Role for Live-Animal Models in Undergraduate Surgical Education During the Cadaver Shortage"

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We thank Swain et al[1] for their thoughtful comments on our article, "A Role for Live-Animal Models in Undergraduate Surgical Education During the Cadaver Shortage." As discussed in our perspective piece, our institution has incorporated the use of a porcine model into our capstone course for graduating fourth-year medical students pursuing surgical residencies.[2] In evaluating the utility of this live-animal model for graduating fourth-year medical students, it is important to consider the broader context of our Duke Surgical Education and Activities Lab (SEAL). SEAL's educational philosophy for trainees, both residents and students, is to teach technical skills, not operations. These technical skills are often taught in the context of an operation, with the model or materials best suited to the objectives and task at hand. Our SEAL lab utilizes a variety of synthetic box models, explanted and preserved tissues, as well as live-animal and cadaver models. Within our broader simulation curriculum for residents, there is a graduated approach to simulation often progressing from box trainers to in vivo models as appropriate.

Swain et al[1] counter our perspective and suggest that alternative synthetic models could be utilized to meet the objectives of our course.[1] In alignment with our SEAL educational philosophy, we agree that animal models should not be the sole form of surgical simulation and education, particularly for teaching surgical anatomy. We also agree that laparoscopic trainers and synthetic models are excellent teaching tools; however, we do worry that overreliance on these teaching methodologies leaves students unprepared for many of the tasks they face during in vivo procedures. For instance, learning how to use bovie electrocautery to obtain hemostasis in a live-animal model may help alleviate "cognitive overload" when asked to use it in a real case. Per our IACUC protocol, the porcine model is only used when no other suitable option is available.

In accordance with our SEAL philosophy, it is important to note that the live-animal model is only one component of our capstone course, which incorporates repeat use of laparoscopic simulators and other models throughout the 2-week period preceding the 2-day operative experience. The full contents and curriculum of the 2-week course, which were out of the scope of the previously published perspective piece, include dedicated skills sessions each afternoon such as advanced suturing, fundamentals of laparoscopic surgery, introduction to robotics, introduction to staplers and energy on explanted and synthetic tissues, stapled and handsewn bowel anastomosis on synthetic bowel, and vascular anastomosis with preserved porcine artery and graft. These skills sessions introduce the students to basic skills, which they can then reinforce and expand on in the live-animal model. In effect, the live-animal model experience provided to students in this course serves as a culmination of experiences preparing them for operating on live tissue. We hold a preparatory session before the live-animal lab to discuss the IACUC protocol, the ethics of utilizing such a model, and the anatomic differences to expect. As noted in our piece, we recognize such anatomic differences[2]; however, the live-animal model can be a very powerful adjunct to other anatomically correct, synthetic models, which have their own intrinsic limitations.[3–5]

Additionally, Swain et al[1] challenge the ability and need for medical students to perform such procedures in a live-animal model. As noted in our perspective piece, these medical students are being guided through procedures by residents and faculty. We believe this supervision may alleviate the 'cognitive overload' suggested by Swain et al[1]. Per our IACUC protocol, these are not survival surgeries. Additionally, emphasis is placed on the students' basic technical skills and utilization of staplers and energy, as they work through each procedure. We do not expect students to masterfully perform such procedures on their own but rather exercise fundamental skills of tissue handling, methods of hemostasis, recognizing surgical instruments, and how to use adjuncts (staplers, energy devices, and laparoscopy). Additionally, this provides our residents with an excellent opportunity to teach and reinforce their own surgical knowledge. Further, the students participating in this course are completing their medical education and are about to start residency programs in surgery. Each of our students is well equipped with anatomical knowledge, and we question the likelihood that they would subsequently confuse anatomic structures during an appendectomy based on their exposure to a porcine salpingo-oophorectomy. Our feedback from students in both formal and informal settings reinforces that this experience does not feel overwhelming but rather rewarding for a group of students who are very motivated in gaining operative experience.

Ultimately, the choice to utilize live-animal models remains at the discretion of individual institutions and their governing bodies. The practices we described in the published perspective piece may not translate well at all institutions. Surgical educators should have an armamentarium of simulation techniques and models by which to teach learners at different stages of training. Our perspective remains that live-animal models can play an important role in surgical education, even at the undergraduate level, if feasible and suitable to the defined learning objectives.

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