ACS 2025 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

P-A-04

Promoting Technology and Collaboration

Improving Education and Safety in Neonatal and Infant Surgery through Development of a Neonatal Minimally Invasive Surgery Model

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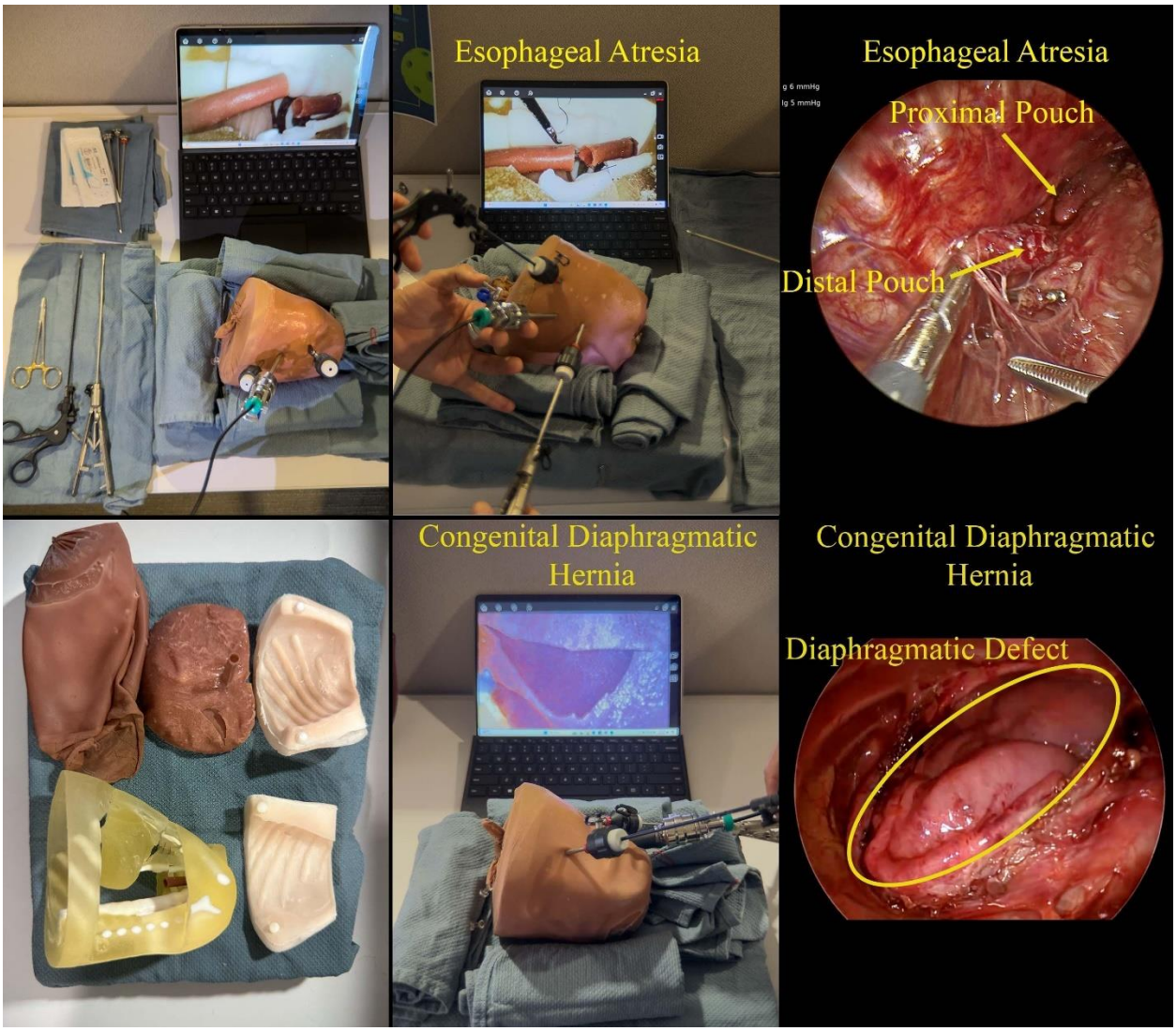
Background: Minimally invasive surgery (MIS) is an essential aspect of surgical care and a core component of surgical training. While graduating surgical trainees achieve sophisticated levels of MIS performance in adult surgery; opportunities and resources for developing excellence in MIS for neonates and infants are limited. MIS training in this group presents unique challenges, requiring repeated deliberated practice due to the complex nature of operations, patient size, confined working spaces, and the delicate nature of their tissues.

Technology Overview: We developed a highly accurate 3D-printed anatomical model of a neonate, tailored to simulate major index operations, such as esophageal atresia and congenital diaphragmatic hernia repair. The use of molded and 3D-printed materials that mimic neonatal tissue's consistency and configuration enables realistic practice of technical steps involved in these procedures. The model's modularity allows for easy customization to meet specific educational needs.

Potential Application in Surgical Simulation and Education: Implementing a curriculum using this 3D model can enhance proficiency in complex MIS surgeries in neonates and infants. This realistic platform allows repeated deliberate practice, having the potential to improve surgical education and increase resident involvement in operations. Having a model that simulates realistic surgery allows recording of reproducible measurements to develop and validate tools for objective assessment of surgical performance, improving the effectiveness of simulation-based training and practice.

Potential Opportunities to Collaborate: Using realistic models to simulate complex neonatal surgery allows opportunities to collaborate in improving simulation design as well as improving objective assessments in how we teach, ergonomics, and measure proficiency in surgery for this population. This approach can also pave the way for integrating artificial intelligence to enhance teaching algorithms and track user progress and improvement over time while providing precision and efficiency feedback. Partnering will be instrumental in refining the model and integrating it into surgical training programs.


Esophageal Atresia
Esophageal Atresia
Proximal Pouch
Distal Pouch
Congenital Diaphragmatic Hernia
Congenital Diaphragmatic Hernia
Diaphragmatic Defect