Laparoscopic Repair of Perforated Peptic Ulcers: A Low-Fidelity Simulator and Training Curriculum for Surgical Skill Development

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Introduction

- Peptic ulcers are lesions in the mucosa of the digestive tract, actively affecting four million Americans.³
- Perforation occurs in 2-14% of cases and is associated with a 20-30% mortality rate塌
- Laparoscopic repair of perforated peptic ulcers (PPE) is associated with shorter hospital stays, less post-operative pain and inflammation, and an earlier return to daily activities³.
- Less than 13% of PPEs are repaired laparoscopically, giving residents and trainees less exposure and fewer operation opportunities³.
- Studies have shown that simulation learning aids in the acquisition of technical skills and improves surgical performance⁴. However, a training model for laparoscopic repair of PPE remains to be developed.

Goal: Evaluate the utility of a cost effective, low fidelity laparoscopic training model and curriculum for bridging the gap of training and teaching the steps and skills required for repair of a PPE.

Methods

- Foam and silicone training models were utilized.
- Participants practicing the mechanical steps of the Graham patch repair of a perforated peptic ulcer.
- silicone sheet with interwoven mesh
- bile-like fluid
- omentum-like silicone patch
- Figure 3 (a) and (b): Interior and exterior of the silicone model, designed to teach the mechanical steps of the Graham patch repair of a perforated peptic ulcer.

Samples:
- 25 trainees watched a training video illustrating the steps of the repair before making three attempts on both training models. The subjects filled out a Likert scale survey which was then analyzed using the Mann-Whitney U-Test.
- Training Video - Instruct Steps of Repair
- Training Model

Results

- Participants found both models enjoyable to use and helpful in learning the steps of the repair.
- Participants preferred the silicone model, reporting it to be more lifelike, to provide a better simulation of the procedure, and to be more effective in the acquisition of laparoscopic skills.
- A silicone-based skill trainer and rapid training curriculum has potential merit as a method to breach the gap of training and teach the technical steps of a laparoscopic Graham patch repair.

Future Directions

- A higher fidelity, 3D printed, laparoscopic simulator will be designed to better simulate and teach the mechanical steps of the Graham patch repair. A hierarchical task analysis will be performed to formally establish a training curriculum and scoring criteria.
- Silicone Model:
  - Participants found both models enjoyable to use and helpful in learning the steps of the repair.
  - Participants preferred the silicone model, reporting it to be more lifelike, to provide a better simulation of the procedure, and to be more effective in the acquisition of laparoscopic skills.
  - A silicone-based skill trainer and rapid training curriculum has potential merit as a method to breach the gap of training and teach the technical steps of a laparoscopic Graham patch repair.

Conclusions

- Silicone sheet with interwoven mesh
- Bile-like fluid
- Omentum-like silicone patch
- Figure 4 (a) and (b): Participants practicing the mechanical steps of the Graham patch repair

Validation: The simulator will be validated by the following experiments
- Face and content validation
- Construct validation
- Concurrent validation

Acknowledgements & Citations

- ¹- Anand, B.S. "Peptic Ulcer Disease." Background, Anatomy, Pathophysiology, Medscape, 17 Aug. 2017

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