Development and Validation of a Novel Surgical Simulator for Thyroid Lobectomy and Recurrent Laryngeal Nerve Dissection

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Objectives

Thyroid lobectomy can be a challenging surgery to learn, due to differences in tumor size, location, and involvement of the recurrent laryngeal nerve (RLN). Complications such as nerve weakness or dysfunction, tumor violation, and hematoma can result in serious quality of life issues and tumor control difficulty. The use of simulation can afford trainees additional exposure to this procedure prior to performance in the operating room.

Methods

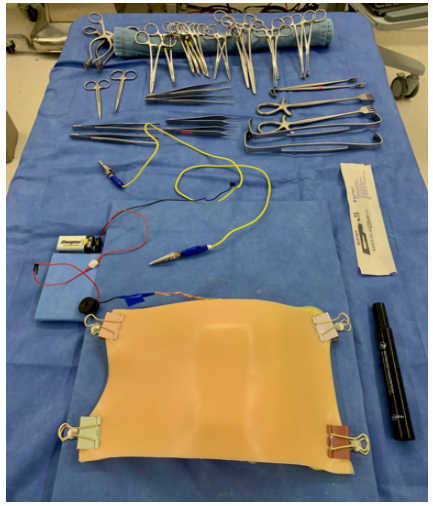
Face validity was achieved using a post-simulation survey and subjective impressions of participants via a 1-5 Likert scale. Demographic information of participants was collected, including surgical specialty and level of prior experience with thyroid lobectomy and RLN dissection. Mean total assessment scores were calculated using a 16-point procedure checklist.

Results

11 participants completed thyroid lobectomy on the simulator after watching a video demonstration. Baseline confidence levels directly correlated with number of previous thyroid surgeries performed. Mean post-simulation confidence scores increased among all residents, with a significant increase among residents who had not previously performed a lobectomy ($P<0.05$). Over half of residents reported they would like to practice on the model again, and believed it was a good tool for training ($n = 6$). Areas for improvement dealt with face validity of the model, with skin and thyroid texture considered the least realistic when compared to human tissue. Participants agreed, on average, that anatomical landmarks and position of the recurrent laryngeal nerve were realistic; likewise, subjects believed that the buzzer was helpful in identifying anatomy and performing a proper surgical approach. All participants agreed or strongly agreed that junior residents would benefit from practicing on the model.

Model

Using silicone and 3D-printed materials, we designed a surgical simulator for thyroid lobectomy and recurrent laryngeal nerve dissection. The surgical trainer mimics the main steps of the procedure and important anatomic landmarks, while integrating the challenge of soft tissue dissection and nerve preservation. A circuited copper wire was used to replicate the RLN, indicating contact with instruments via audio feedback.



Conclusions

This model is the first reported conceptualized trainer for thyroid surgery. Although face validity is somewhat limited by fidelity, the benefits of low cost and ease of replication will enhance availability, increase learner confidence, and contribute to the surgical education of trainees in a safe environment prior to participating in live surgery.

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References:

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