Anatomic Model For Surgical Skills Training – Myringotomy with Tympanostomy Tube Placement

Amy L. Ingram, MD, Jennifer Bartlett , ST , James P. Malone, MD
Division of Otolaryngology, Southern Illinois University School of Medicine

Objectives

Our objective was to design an inexpensive, reproducible and realistic anatomic model to simulate myringotomy with tympanostomy tube placement for use in the surgical skills laboratory. The model will be utilized for surgical skills training and to familiarize residents with the operating microscope, the surgical instrumentation, and the surgical anatomy used during a typical procedure.

Background

The effectiveness and importance of proficiency based training (PBT) has been well described in the General Surgery literature. Evidence suggests that error reduction in the operating room, and improved clinical decision making,[1,2] are among the many benefits associated with PBT. A recent poll of Otolaryngology program directors described the lack of objective surgical skills evaluations within Otolaryngology and recommended that "All Otolaryngology training programs should be developing and implementing formal surgical assessment tools."[3] In addition to being a core procedure set forth by the American Board of Otolaryngology, 83% of program directors agreed that myringotomy with tympanostomy tube placement should be mastered by all PGY-2 residents.[4] The purpose of this project is to develop a reproducible, anatomic model for myringotomy with tympanostomy tube placement that can be used for PBT in Otolaryngology residents in the surgical skills laboratory.

Materials

The following materials were used: polystyrene foam head ($6.00), T-pins($0.50), the cut tip of a bulb syringe - medical discard($0), Glad Press n' Seal Wrap® ($3.00), the external ear with curved ear canal obtained from the Ear Examination Simulator by Life/form® ($32.00), Butter-flavored Crisco ($3.30), and latex paint ($7.00). TOTAL: $51.80. (Fig.1)

Figure 1

Methods

MODEL DESIGN: The model was formed by sawing a polystyrene foam head in half in the saggital plane. An opening was carved into the lateral aspect of the head for insertion of the simulator ear (Fig.2). Directly opposing this site on the medial aspect of the foam head, an opening was cut to accommodate the Re-usable Middle Ear assembly (RME) (Fig.3). To allow for a window the medial portion of the Lifeform® Simulator Ear was removed (Fig.4) and the ear placed within the cut external opening of the head (Fig.2 and 5). This portion of the model remains permanently assembled.

Figure 2.

Figure 3.

The RME assembly was created by molding a T-pin to represent a malleus. This was then secured at the inner edge of a three cm segment of a detached bulb syringe tip (Fig.6). Flesh colored latex paint was later added to improve natural coloring.

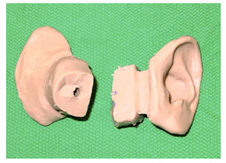


Figure 4.

ASSEMBLY: A small square of Glad Wrap®, which acts as the disposable tympanic membrane, was then draped over the RME apparatus (Fig.7). The entire assembly was placed within the medial opening of the head to align with the external ear canal (Fig.8). A mark on the superior edge of the model and RME assembly ensured anatomic alignment of the landmarks.

Figure 5.

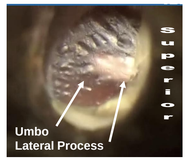
Figure 6.

Figure 7.

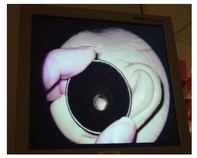
Figure 8.

Results

Normal anatomic view of right tympanic membrane



View under the microscope of model TM demonstrating landmarks. (As seen on Meti®)

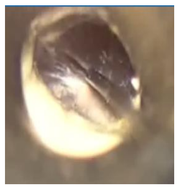


Low-powered view on the teaching LCD video monitor

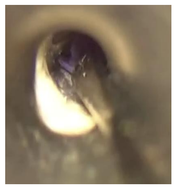
Figure 9.

ANATOMIC VALIDITY: The view through the operating microscope reveals the landmarks necessary for proper tube placement (Fig.9). As seen in Figure 10 a myringotomy with tympanostomy tube placement was performed under the operating microscope with the finished model. Subjectively, the texture of the Glad Wrap® is similar in feel to a normal tympanic membrane and allows for multiple uses by either adjusting or replacing it after each myringotomy. The tube is readily retained in the simulated tympanic membrane. The curved ear canal on the model requires manipulation of the head and microscope to align the canal for proper visualization of the tympanic membrane. Butter Flavor Crisco® can also be added to imitate cerumen impaction.

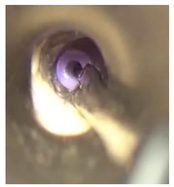
View captured with the METI Automated Video Capturing System®.



Incision with myringotomy knife



Insertion of Armstrong grommet tympanostomy tube



Placement verification

Figure 10.

To date, the model (or an earlier version) has been utilized in conjunction with a skills laboratory (set-up seen in Figure 11) run by chief residents for training interns prior to their entering the operating room and for additional practice for residents having difficulty performing this procedure in the operating room. The SIU otolaryngology residents using this training model reported the greatest benefits included: the opportunity to become familiar with the instrumentation and experience manipulating the microscope and instruments in a setting outside of the operating room.

Discussion

The total cost of the model was approximately $50.00 including replacement parts for disposable portions, and could be reproduced at other institutions.

In addition to skills training, this model has the potential to be utilized as an objective assessment of surgical skills in otolaryngology residents. Figures 9 and 10 were captured on the METI Automated Video Capturing System®. We are currently developing a surgical skills module, curriculum, and web based evaluation tool for myringotomy. We have future plans to analyze the impact and validity such a tool would have on otolaryngology residents in training.

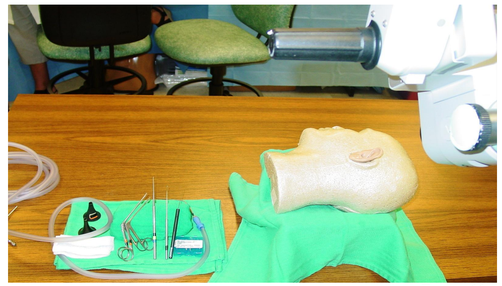


Figure 11.

Conclusion

The model developed is a reproducible and realistic anatomic model for simulation training of myringotomy with tympanostomy tube placement. This model has been employed successfully by residents and can be created utilizing inexpensive materials.

References

1. Alberg G, Enochsson L, et al. Proficiency Based Virtual Reality Training Significantly Reduces The Error Rate for Residents During Their First 10 Laparoscopic Cholecystectomies. AM J Surg. 2007; 193(6):797-804.
2. DaRosa D, Hauge L, et al. Impact of a Structured Skills Laboratory Curriculum on Surgery Residents' Intraoperative Decision-Making and Technical Skills.
3. Brown DJ, Thompson RE. Assessment of operative competency in otolaryngology residency: Survey of US Program Directors. Laryngoscope. 2008 Oct;118(10):1761-4.
4. Carr MM. Program directors' opinions about surgical competency in otolaryngology Laryngoscope. 2005 Jul;115(7):1208-11.
5. METI® Learning System http://www.meti.com/main_faq.htm.