

microscope under local anesthesia, and complete closure was achieved in 54 (90%). Eighty-four ears were treated by a SUM under general anesthesia, and closure was achieved in 74 (88%). Endoscopy (1.9 mm in diameter) was performed in 14 ears, of which 13 (93%) attained TM closure. There were no significant differences in closure rates among the surgical procedures selected, and neither enlargement of perforation nor decreased hearing acuity occurred, as compared to the preoperative condition, even in patients suffering reperforation.

Conclusion: This operative procedure is simple and minimally invasive, and provides a satisfactory perforation closure rate. The present data indicate that selection of operative procedures appropriate to various disease states may permit greater extension of surgical indications.

Otology/Neurotology

Radiation-Induced Sensorineural Hearing Loss

Mario Mujica Mota, MD (presenter);
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Objective: To systematically review the literature to characterize radiation-induced sensorineural hearing loss for head and neck tumors.

Method: Seven databases were searched to identify studies assessing the characteristics of sensorineural hearing loss caused exclusively by radiotherapy for head and neck cancer.

Results: Fourteen articles were evaluated. The reported incidence of sensorineural hearing loss was higher on frequencies above 4 Hz (up to 95%) when compared to the speech frequencies. Radiation dose and follow-up time were important factors affecting incidence rates.

Conclusion: Evidence demonstrates that the resulting SNHL is irreversible, progressive, and dose-dependent. High-quality literature regarding SNHL due to radiotherapy is lacking. Improved evaluation protocols should be adopted in the standard of care for patients undergoing radiotherapy.

Otology/Neurotology

Recurrence in Cholesteatoma Surgery and the Use of Laser

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Objective: Cholesteatomas have a high-rate of recurrence, regardless of the surgical approach used. Our hypothesis was that use of the handheld CO₂ laser would reduce recurrence of cholesteatoma by removing microscopic disease, particularly in challenging or difficult to treat areas.

Method: A total of 384 mastoidectomies performed by a single-surgeon between 2006 and 2011 were reviewed (22 in the non-laser and 23 in the laser group that met the inclusion criteria). Outcome measures included recurrence rate and complication

rates. Independent variables included smoking status, bilaterality and the extent of disease as assessed by Marres staging (1984).

Results: Average follow-up was 25 months; average separation between the first and second stage was 8 months. There were 1 Marres stage 1, 29 stage 2, 1 stage 3, and 13 stage 4 patients and the distribution between the 2 groups was similar. There were no facial nerve paralysis cases, and 1 sensorineural (SNHL) hearing loss after the first procedure in the nonlaser group. There was no difference in the rate of recidivism noted at the second stage between the laser group (34.8%) and non-laser group (30.4%). There was no apparent correlation between smoking status or bilaterality of disease and recurrence.

Conclusion: While the safety of cholesteatoma surgery with handheld laser is confirmed without any incidence of SNHL or facial nerve paresis, in this retrospective study, there does not appear to be any reduction in the rate of recidivism. A prospective study is clearly warranted to demonstrate efficacy.

Otology/Neurotology

Robotic Tremor Suppression: A Tool for Stapes Surgery?

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Objective: 1) Create a custom micropick for Micron, a fully handheld robotic micromanipulator. 2) Demonstrate phenomenon of physiologic tremor and evaluate bracing technique in simulated otologic surgery. 3) Evaluate feasibility and efficacy of Micron, to decrease surgeon tremor, positioning error, and force applied in tasks simulating otologic surgery.

Method: Two positioning conditions tested: hovering mid-air and lightly contacting surface. 3D axes error, tremor, and force measurements. Experimental conditions: 1) unaided, 2) unaided with bracing, 3) Micron alone, 4) Micron with bracing. Tremor and position error were analyzed with a high-pass filter. Significance ($P < .05$)(*) via 2-tailed t test.

Results: Positioning Error: Root mean square (RMS) and maximum error (ME) are reported. Reduction in ME was seen in the surface task, with bracing alone and Micron alone. However, the hover task showed significant benefits with only Micron + bracing. Force Error: RMS and maximum force error showed no difference between conditions. Tremor Error: Positioning error contains tremor and overall drift from the goal position. Statistically significant reduction in tremor both in RMS and ME is seen with Micron, bracing, and the combination. Micron + bracing produced the largest reduction in tremor.

Conclusion: Our initial results demonstrate Micron significantly reduced maximum positioning error (tremor) in simulated otologic surgery. Additionally, we confirmed bracing significantly dampens tremor. Interestingly, the use of Micron and bracing yielded the largest reduction in tremor, suggesting an additive effect. No difference in force applied was found.