OTOLOGY & NEUROTOLOGY

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LASER REMOVAL OF CHOLESTEATOMA DURING A TYMPANO-MASTOIDECTOMY USING A HAND-HELD CO_2 LASER FIBER

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The patient, a 70 year-old female, presented with conductive hearing loss and whitish discoloration of the tympanic membrane suggestive of middle ear to mastoid cholesteatoma. Upon surgical exposure, cholesteatoma was found in the posterior tympanic recess with extension into the mastoid antrum. Disease in the posterior tympanic recess extended to the subiculum, ponticulus, and the inferior convex surface of the posterior crus of the stapes. With a laser mirror, inspection of the stapes arch found hidden cholesteatoma in the arch of the footplate-posterior crus junction. The CO_2 laser fiber (BeamPath™ OTO-M) was introduced for non-contact dissection and was used with a 300 µm spot size diameter at power settings of 3-8 watts with 0.1 sec short pulses. Inert gas flow was used to clear the surgical field and assist with coagulation. The CO_2 laser fiber allowed for atraumatic removal of the posterior crus of the stapes providing access to the posterior oval window niche and the footplate. Cholesteatoma was then removed using the CO_2 laser fiber and bleeding was controlled with the fiber in its coagulation mode. Diseased tissue was removed in its entirety without any trauma to the stapes footplate, the capitulum, or the anterior crus. Once disease removal was complete, further inspection found a fixed stapes footplate which will be repaired by laser stapedotomy in a second procedure 6 months to a year from the date of the initial procedure.

PATIENT PROFILE

70 year-old female with right-sided conductive hearing loss

No history of previous otologic surgery

Pathology speculated to be cholesteatoma in the middle ear and around the mastoid

Following a discussion of the risks and benefits, the patient chose to undergo surgery

SURGICAL COURSE

- Under anesthesia a postauricular transcanal approach to the right ear was used.
- Cartilage and fascia grafts were harvested.
- Cholesteatoma was confirmed as the pathology, it was found growing subcutaneously in the posterior canal wall back into the mastoid cavity.
- The cholesteatoma had eroded the bony partition between the ear canal and the mastoid and had created its own pocket 1 cm in diameter.
- After removal of posterior tympanic recess cholesteatoma, laser mirror inspection identified additional disease in the stapes arch, adjacent to the footplate-posterior crus junction (*Fig.1*).
- The CO_2 laser fiber (BeamPath™OTO-M) was then introduced for non-contact dissection and was used with a 300 µm spot size diameter at power settings of 3-8 watts with 0.1 sec short pulses.
- The CO_2 laser fiber allowed for atraumatic removal of the posterior crus of the stapes (8 watts, 0.1 sec pulses) providing access to the posterior oval window niche and the footplate (*Fig.2*).
- The laser fiber was used to trim the stapes muscle (6 watts, 0.1 sec pulses) following partial drilling of the pyramidal eminence to provide exposure and visualization.
- Bleeding vessels were coagulated using the CO_2 laser fiber (6 watts, 0.1 sec pulses), fired while slightly retracted from the target tissue in order to disperse the energy and achieve hemostasis.
- The laser fiber was then used to ablate and peel away the cholesteatoma layer-by-layer (*Fig.3*) off the stapes footplate (3 watts, 0.1 sec pulses). The diseased tissue was removed in its entirety without any trauma to the stapes bone (*Fig.4*).
- After cholesteatoma removal, inspection found a fixed stapes footplate. A laser stapedotomy will repair the defect at a second procedure 6-12 months after the primary procedure.

POSTOPERATIVE RESULTS

The patient was awakened in the operating room. No symptoms of vertigo were exhibited. Follow-up hearing tests were scheduled for 3 months from the date of the procedure. A second procedure to repair conductive hearing loss was planned 6-12 months from the date of the procedure.

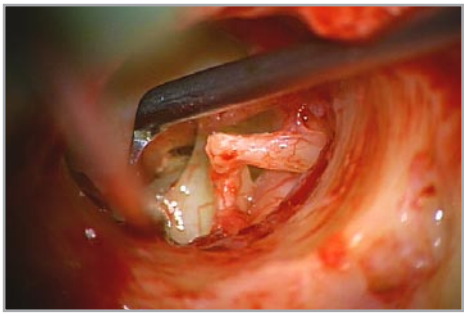

Figure 1: Cholesteatoma in the stapes arch seen reflected in the laser mirror

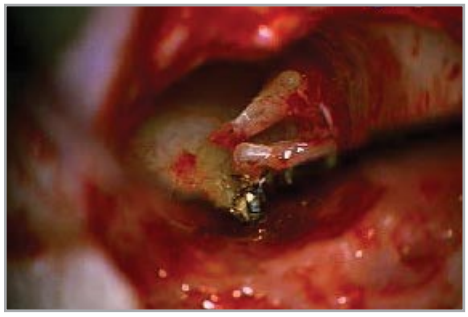

Figure 2: CO_2 laser fiber (BeamPath™ OTO-M) ablating the stapes crus

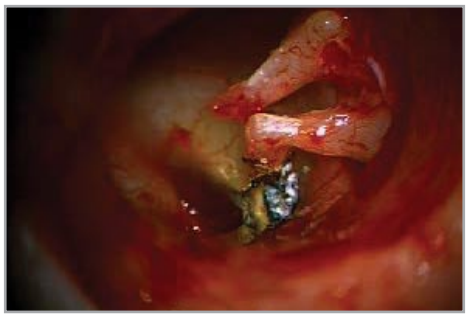

Figure 3: Cholesteatoma on the stapes footplate following gentle ablation

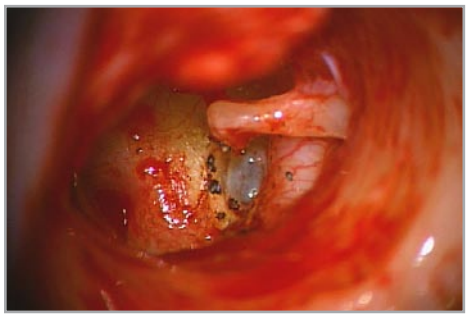

Figure 4: Cholesteatoma removed, footplate exposed

DISCUSSION

The CO_2 laser fiber provided a less traumatic approach to the posterior oval window niche and the stapes footplate than could have been achieved with mechanical methods. The fiber-enabled delivery of CO_2 energy allowed for precise layer-by-layer dissection and removal of disease with a minimal-touch, atraumatic technique. Although visible light and line-of-sight CO_2 lasers also use minimal-touch techniques, they lack the cooling inert gas flow of the CO_2 laser fiber. The gas flow clears the surgical field of blood and debris enhancing the fiber's cutting and coagulation abilities. The flow ensures laser energy is not absorbed by pooling blood and that oozing capillaries are more readily coagulated. The BeamPath™ OTO-M CO_2 laser fiber (OmniGuide,® Cambridge, MA) enabled precise layer-by-layer removal of diseased tissue in a time-efficient manner which also enhanced safe middle ear surgery, minimizing inner ear risk.

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