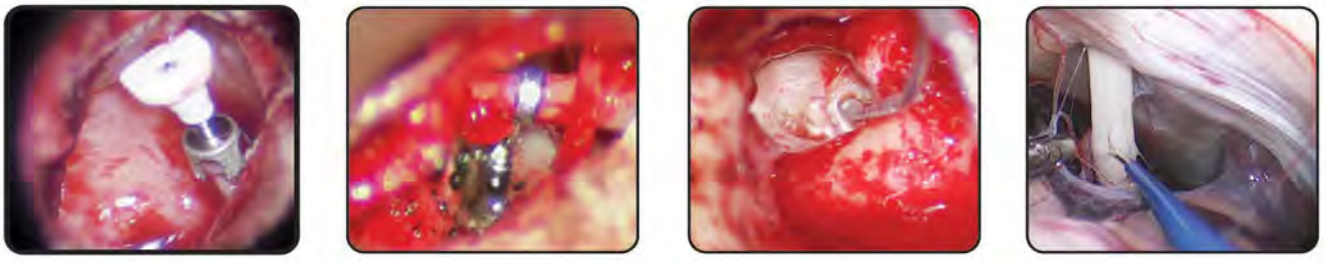
Surgical Techniques in Otolaryngology—Head & Neck Surgery

OTOLOGIC & NEUROTOLOGIC SURGERY



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General Considerations in Otologic and Neurotologic Surgery

Michael J LaRouere

INTRODUCTION

Performing otologic and neurotologic surgery requires attention to the most minute details. This is ever so apparent in the operating room. In order to achieve the best results, otologic surgeons find that routine is of utmost importance. Variations from a routine may lead to errors and poor outcomes.

Operating room personnel include the surgeon, experienced scrub and circulating nurses who have a thorough understanding of otologic instrumentation and an anesthesiologist familiar with neuroanesthesia and nerve monitoring. Additional personnel can include a neuromonitoring team who has good rapport with the surgeon. Finally, a good surgical team consisting of a neurotologist and neurosurgeon who have a thorough understanding of each other's role in the particular procedure is essential.

Fig. 1.1: Panoramic view of an otology room setup. The table is rotated 180°. The surgeon is opposite the scrub nurse. The operating microscope is at the head of the patient, anesthesia at the foot. An intraoperative monitor is located behind the surgeon, giving real-time feedback regarding facial nerve stimulation

OPERATING ROOM EQUIPMENT

The operating room table is unique to otology. The bed is usually rotated 180° away from anesthesia with the patients head at the foot of the table. This allows the surgeon to be seated with his legs under the table (Fig. 1.1). Being able to rotate the bed side to side allows for optimal visualization of the surgical field through the microscope. Important for the operating surgeon is a chair with a back and arm rests. This allows for arm support, thereby decreasing fatigue (and also decreases the likelihood of neck, arm, and shoulder problems in the future) (Fig. 1.2).

The operating microscope is positioned at the head of the bed. The microscope should be freely moveable yet able to lock in position to prevent drift (Fig. 1.1).

Our experience scrub nurses control suction and irrigation. The surgeon controls fine suction with his thumb over the control hole. Our scrub nurses also control the on and off function of the otologic drill responding to the surgeons voice. This allows the surgeon to concentrate on the procedure and eliminates the need for the surgeon to control the drill with his feet. The scrub nurse is routinely positioned across the head from the surgeon, making the passing of instruments straight forward.

Monitoring

Facial nerve, auditory brainstem-evoked recordings and lower cranial nerve monitoring have become routine in otologic and neurotologic surgery.[1,2] Having a thorough understanding of the specific monitoring technique is of the utmost importance. Poor monitoring is worse than no monitoring at all.[3] We stress the importance of intraoperative stimulation (active monitoring as opposed to passive monitoring) to assess the function of both the equipment as well as the nerve. This involves electrically stimulating the nerve as early as possible in all cases in which monitoring is used. Currently, we use a constant current facial nerve monitor with the EMG recording displayed both visually and audibly (Medtronic) (Fig. 1.3).

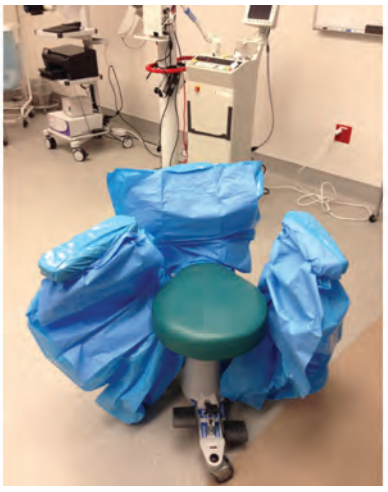

Fig. 1.2: An otology operating chair with arms is sterilely draped. Arm rests allow for continuous arm support

Fig. 1.3: A constant current facial monitor is shown that allows both visual and auditory feedback

Fig. 1.4: Electrodes are placed in a bipolar montage. Two channels are generally used: one based above the brow (orbicularis oculi) and the other in the orbicularis oris. A ground electrode is placed over the sternum and an anode electrode is also placed over the sternum to allow for monopolar stimulation. This patient has a monitoring endotracheal tube in place

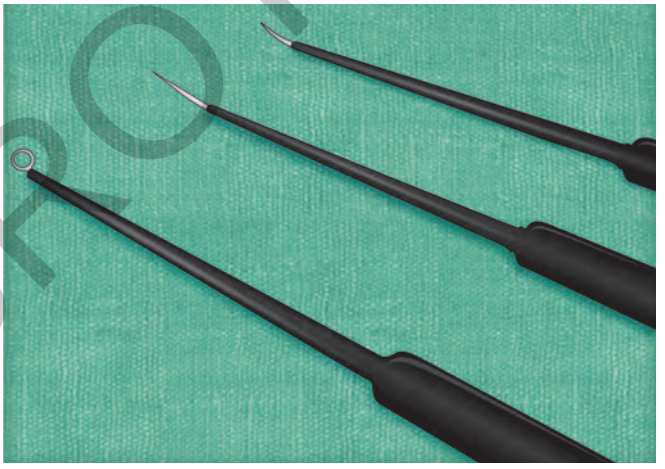

Fig. 1.5: Kartush stimulating dissectors are shown. These are insulated to just before the tip and allow for simultaneous dissection and stimulation

Electrode placement for otologic and neurotologic surgery is done in a two-channel montage. A pair of needle electrodes are placed in the orbicularis oculi and orbicularis oris muscles. We place a ground electrode over the sternum in addition to an anode electrode for monopolar nerve stimulation (Fig. 1.4).

Several steps should then be followed to ensure adequate facial nerve monitoring:

Step 1: After insertion check electrode impedance (<5k Ohms).

Step 2: Confirm current flow back to the monitor.

Step 3: Obtain an early baseline response (active monitoring). This is usually done over the tympanic segment of the nerve.

Unique to motor nerve (facial, lower cranial nerve) monitoring in our practice is the use of intraoperative stimulus dissectors. Developed by Dr Jack Kartush, the stimulus dissectors are insulated to near the tip (Fig. 1.5), allowing for simultaneous stimulation and surgical dissection. These instruments have proved to be invaluable in tumor dissection and also in chronic ear surgery when cholesteatoma and granulation tissue surround the facial nerve.

Errors in monitoring usually result in false negative responses or a lack of response. Rarely a false positive response can occur—usually due to current spread from using too high a current level. False negative responses can occur with current going through CSF or blood. Lack of a

response can be due to nerve injury, anesthesia, faulty setup or lack of sufficient current.

Intraoperative auditory brainstem-evoked recordings have proven to be useful in several neurotologic procedures when hearing preservation is a goal. Acoustic tumor surgery, vestibular nerve section, and microvascular decompression surgery are the major procedures in which intraoperative ABR monitoring is routinely used. As with facial nerve monitoring, electrode placement is critical. The insert earphone should be placed securely in the ear canal after the canal is cleaned of wax and prep solution. Baseline recordings should be established prior to beginning the surgical procedure.

ABR changes are not related to depth of anesthesia. Increased latencies/decreased amplitudes are seen with eighth nerve injury and injury to the internal auditory artery. Other causes of ABR changes include fluid in the middle ear and opening the dura prior to any intervention near the nerve.

In the majority of cases, loss of the ABR signal altogether signifies poor postoperative hearing. This does not always correlate however as we have seen normal postoperative hearing results with marked intraoperative ABR changes.

ANESTHESIA

Unique to otologic and neurotologic surgery is the relationship of the surgeon to the anesthesiologist or nurse anesthetist. This is especially important in conscious sedation cases where patient movement at a critical juncture of the procedure can be met with poor results. Also important is the choice of anesthetic agents during cases in which motor nerve (i.e. facial) monitoring is used. The absence of long-term paralyzing agents while keeping the patient still needs to be communicated to the anesthetic team. Short-acting paralytic agents are routinely used for intubation, and a train of four testing is done to ensure the effect of these agents has dissipated prior to beginning the surgical procedure.

Local anesthetic injections need to be monitored closely by the operating surgeon. Inadvertent infiltration of the facial nerve can render facial nerve monitoring useless. This is why active monitoring of the facial nerve during all otologic and neurotologic procedures is critical.

Further the use of agents to help with brain relaxation (decreased $PaCO_{2,}$ Mannitol, Lasix, Hypertonic Saline) need to be appropriately timed by both the surgical and anesthetic team.

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Otologic & Neurotologic Surgery is part of a comprehensive series entitled "Surgical Techniques in Otolaryngology—Head & Neck Surgery". Other atlases in the series are devoted to various specialties within the field, including Head & Neck Surgery, Sinonasal Surgery, Laryngeal Surgery, Facial Plastic & Reconstructive Surgery, and Pediatric Otolaryngologic Surgery.

Seventeen chapters are included in this volume. Each chapter discusses various otologic and neurotologic disorders followed by a detailed step by step description of the surgical procedure used to treat each condition. Intraoperative photographs and drawings accompany the description of each operative procedure. Related complications are discussed. This volume is a thorough guide geared toward practicing otolaryngologists, otolaryngology residents, and fellows performing otologic and neurotologic surgery. Surgical pearls in tympanoplasty, ossicular chain reconstruction, mastoidectomy, stapedectomy, cochlear implantation, and skull base surgical procedures are covered. Newer surgical procedures such as over/under tympanoplasty, superior canal dehiscence repair, and endoscopic approaches to the posterior fossa are introduced and discussed in detail.

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ISBN 978-93-5152-463-2
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