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New techniques for tonsillectomy and adenoidectomy

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New techniques for adenotonsillectomy offer reduced morbidity and improved recovery by limiting tissue injury. The authors review three new instrument-based approaches to adenotonsillectomy and offer data to demonstrate the prevalence of technique and device use across several different geographic regions.

Adenotonsillectomy (T&A) technique varies by patient age, indication for surgery, the surgeon's experience, and available equipment. Significant recent changes in indications for T&A, such as more surgery for sleep-disordered breathing and for milder presentations of obstructive sleep apnea, as well as in equipment and surgical experience have driven us to adopt new techniques and technologies. This article will review in detail the following: (1) partial tonsillectomy using the Medtronic (Medtronic, Jacksonville, FL) and Gyrus (Gyrus-ACMI, Memphis, TN) microdebriders and coblation (Arthrocare, Sunnyvale, CA); (2) complete tonsillectomy with coblation and Gyrus Plasmacision instruments; and (3) adenoidectomy using Medtronic microdebriders, coblation, and the Gyrus Plasmacision instruments. We begin with an overview of general principles and unique aspects of newer technologies.

General technique

Exposure

Successful surgery depends on excellent exposure, tissue tension, and knowledge of the relevant anatomy. Oro- and nasopharyngeal exposure for T&A is best achieved using a Crowe-Davis style mouth gag with an open side (Figure 1). Gags that open to both the left and right per the surgeon's preference are available. Soft palate examination is performed to confirm that there is no submucus cleft. Submucus cleft mandates partial adenoidectomy, preserving either a central or inferior ridge of adenoid tissue, to reduce the risk of postoperative velopharyngeal insufficiency (VPI). Cephalad soft palate retraction is then performed using bilateral transnasal nonlatex-containing suction catheters to optimize nasopharyngeal exposure as well as to maximize tissue tension of the superior tonsillar poles. Strong soft palate retraction also prevents injury to the nasopharyngeal side of the soft palate, particularly during microdebrider and coblation techniques. Dentition may be protected by a plastic or rubber athletic mouth guard and careful mouth gag placement. Care is taken not to allow the lateral flanges of the tongue blade of the gag to scratch dental enamel. Protection of the mucosa from electrical and thermal conductivity is achieved by interposing a gloved finger between the instrument metal and the patient.[1] Tissue tension during complete tonsillectomy is achieved by strong medial traction of Allis clamps and torsion of the tonsils medially (Figure 2).

Local anesthetic infiltration

Local infiltration of 0.25% bupivicaine and 1:200,000 epinephrine into the loose connective tissue between the

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Figure 1 Open-sided mouth gag (Davis Mouth Gag, Medtronics, Jacksonville, FL). Figure used with permission from The Nemours Foundation.

capsule and lateral pharyngeal wall facilitates tonsillectomy by medializing the tonsil and provides perioperative anesthesia and analgesia, which may promote intraoperative hemostasis. Coblation complete tonsillectomy is additionally aided by local anesthetic infiltration because it provides a fluid medium to provide protons that are available for tissue ablation.

Surgical safety

Surgical safety demands mental, technical, and structural ("systems") considerations. Before surgery, learning through simulation and hands-on device use in a laboratory setting or formal course is ideal. After the induction of general anesthesia, the surgeon should assess the tube size and the position to evaluate dentition for chips and looseness. Special consideration of cervical spine issues must be heeded in the Down syndrome patient, for example, in which extensive cervical extension and rotation is to be avoided. The authors recommend against a shoulder roll and excessive neck rotation for such children.

Airway fire

Awareness of techniques for managing airway fires is mandatory. Suspicion of an airway fire requires the following: immediate extinguishing of the fire by water, which should be placed in front of the surgeon on the Mayo stand; notification of the operating room team; removal of the endotracheal tube; protection of the airway; and then inspection for airway injury. Drills for airway fire manage-

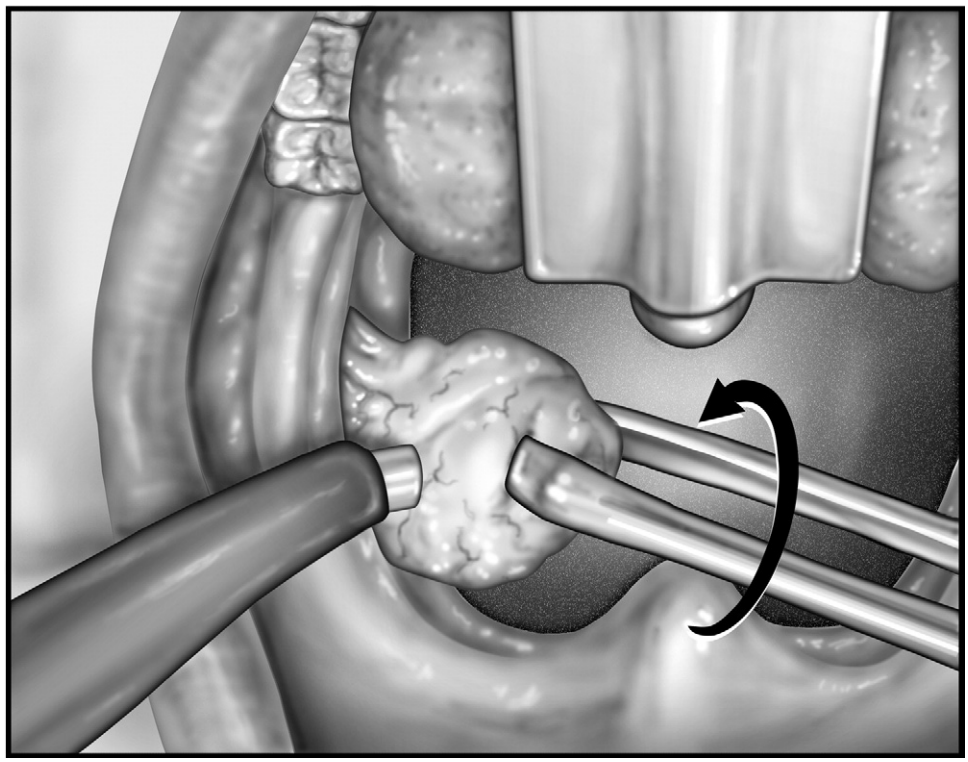

Figure 2 Torsion during tonsillectomy. Figure used with permission from Dr Steven Cook.

ment should take place early in surgical training, on a mannequin or surgical simulator, and in the operating room with staff on a regular basis. Verbalization of this drill should be routinely practiced, given the potentially severe complications of late recognition or poor management of an airway fire.[2]

Technologies

Although most readers are familiar with the high-speed bidirectional oscillation provided by microdebriders (Medtronic, Jacksonville, FL and Gyrus, Bartlett, TN), Coblation and jPK technologies are relatively newer. We briefly review these before discussing technical details of surgical approaches.

Coblation

Coblation can be used for partial or total tonsillectomy and for adenoidectomy. The authors prefer the Coblation EVac Xtra. This has a wider suction channel and differently placed irrigation than prior devices. Coblation works by energizing protons of a saline solution that ablates tissue and is hemostatic for small vessels. The depth of injury is less than monopolar electrocautery.[3]

The device is tested before use by pressing on the "ablate" foot pedal until saline is seen coming from the wand tip. Saline is dripped onto the blue towel to saturate a 1-cm^2 area, and a yellow–orange glow at the tip should be seen when the tip is brushed in "ablate" mode on this area.

Wand clogging is prevented by the following:

1. Brushing the tip against a moist cloth towel, with or without ablation.
2. Frequent intraoperative suctioning of a slightly soapy saline solution (baby shampoo is used by the authors), with or without hitting "ablate."
3. Forced irrigation through the suction port with a 10-mL syringe using saline, whereas ablating under the soap–saline solution helps "shoot out" occluding fragments of debris.

Hemostasis is achieved by laying the grill against larger vessels and losing the sound of the suction (Figure 3). "Coag" is then hit for several seconds. Some practitioners like to hear a popping noise. This can be done on bleeding vessels as well as prophylactically. The foot pedal should be in the surgeon's line of sight and not under the table. The foot should rest on the gray central post when power is not being used, and visual and auditory confirmation is critical to ensure that the appropriate pedal is depressed ("ablate" has a higher pitched sound than "coag"). The wand should always be directed medially to avoid vascular injury. Deliberate motion of the wand results in more effective hemostatic tissue removal rather than short, hasty strokes.

Figure 3 Hemostasis with coblation. (A) Bleeding vessel. (B) Coagulation with wand. (C) Dry fossa after coagulation. Figure used with permission from The Nemours Foundation.

Plasmacision

Plasmacision is performed using the jPK device, which creates a plasma energy field using tissue electrolytes, as opposed to needing saline as with coblation. The tip has a "j" shape to facilitate tissue dissection, especially against

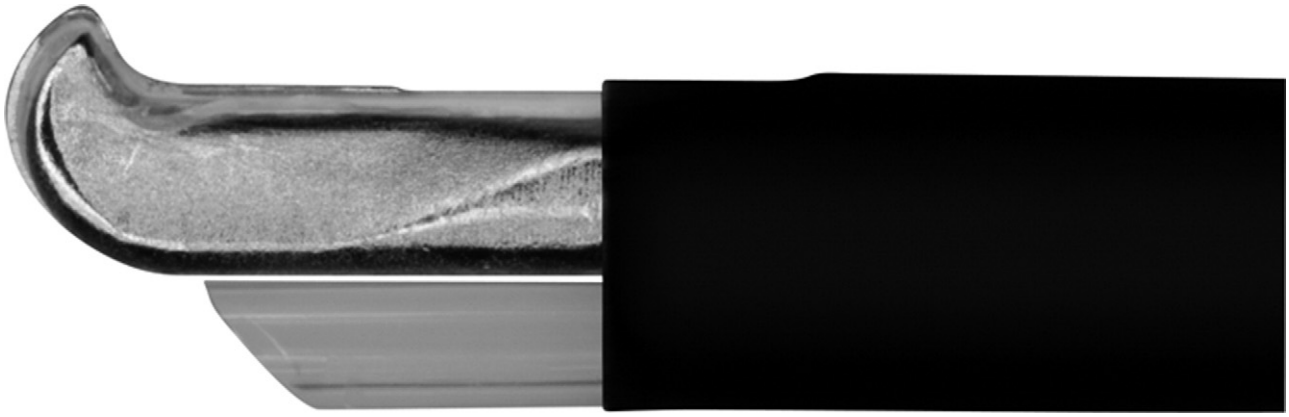

Figure 4 Plasmacision (jPK tip; Gyrus-ACMI, Memphis, TN).

the inferior tonsillar poles, and may be delivered using a disposable wand or a nondisposable hand piece (the TA2 device). The flexible shaft is able to coagulate, ablate, and suction (Figure 4).

Techniques

Partial tonsillectomy

Partial tonsillectomy, or tonsillotomy, involves removal of most of the tonsil, while preserving a rim of lymphoid tissue and tonsillar capsule in the most recent iteration of this older technique.[4] Preservation of this margin of tissue, this "biologic dressing," may promote an easier recovery, with lower hemorrhage rates and better recovery of diet and activity reported in comparison with traditional monopolar tonsillectomy techniques.[5,6] Partial tonsillectomy, also referred to as intracapsular tonsillectomy, may be performed for obstructive sleep apnea, chronic pharyngitis, upper airway resistance syndrome, and sleep-disordered breathing. Exteriorization of the tonsillar crypts must be achieved if partial tonsillectomy is to be effective for managing infection. In our practice, we have also found the microdebrider and partial approach useful for management of peritonsillar abscess by quinsy tonsillectomy. Partial tonsillectomy should not be performed for diagnosis or management of tonsillar neoplasia.

Near total tonsillectomy is achieved by tissue reduction until the fibrous strands of the capsule are evident. Partial tonsillectomy may be achieved with either the noncauterizing microdebrider (Medtronic, Gyrus) or a microdebrider with electrocautery that aids in hemostasis (Gyrus), or by coblation using the "lop off" or the tissue-reduction techniques (Figure 5).

Microdebriders

Bidirectional oscillation at a speed of 1800 Hz is recommended with variable foot pedal control. Tissue eversion of the superior pole is useful to ensure thorough reduction of this sometimes-difficult area to access. The mirror for visualization is useful here as is the Hurd elevator. Reduction begins at high speed in the center of the tonsil, medially, and the surgeon works toward each pole in a methodical and deliberate manner, from superior to inferior and then back in the other direction. Hemostasis, when available using the Gyrus microdebrider, may be applied concurrently with the cutting foot pedal to optimize hemostasis. Irrigation into the blade shaft reduces clogging and facilitates expedient reduction. Blades are available with varying degrees of angulation and may be chosen according to the operator's preference. Additional hemostasis may be achieved using suction electrocautery.

Coblation for partial tonsillectomy

Large tonsils may be reduced most effectively by the "lop off" technique, truncating the tonsil from anterior to posterior using ablate and coag as required to achieve a hemostatic plane (Figure 5). Further tissue reduction to the fibrous strands and then to evacuate the crypts adjacent to the pericapsular region is achieved using ablate when more than 3 mm lateral from the lateral pharyngeal wall and coag when closer. Wand clogging is prevented as detailed earlier in the text.

Smaller tonsils may be reduced as described in the preceding paragraphs, by shaving down, as one would cut shrubbery, using a combination of ablate and coag. Experienced coblation users rarely require additional or "rescue" hemostasis with electrocautery. When required, rescue cautery is usually used for inflamed or infected tissue.

Complete tonsillectomy

Coblation complete tonsillectomy

Local anesthetic is infiltrated into superior and midportions of the tonsillar capsule to facilitate dissection and may reduce postoperative pain. The tonsil is grasped and firmly retracted medially (Figure 2). A mucosal incision using coblation with ablate at power of 7 is begun either at the lateral margin of the tonsil or at the superolateral aspect of the anterior pillar while hugging the tissue and seeing the orange glow with the tip aimed medially. Identification and early control of vessels is achieved by deliberate and gentle dissection. Proceeding in this manner from superolateral to

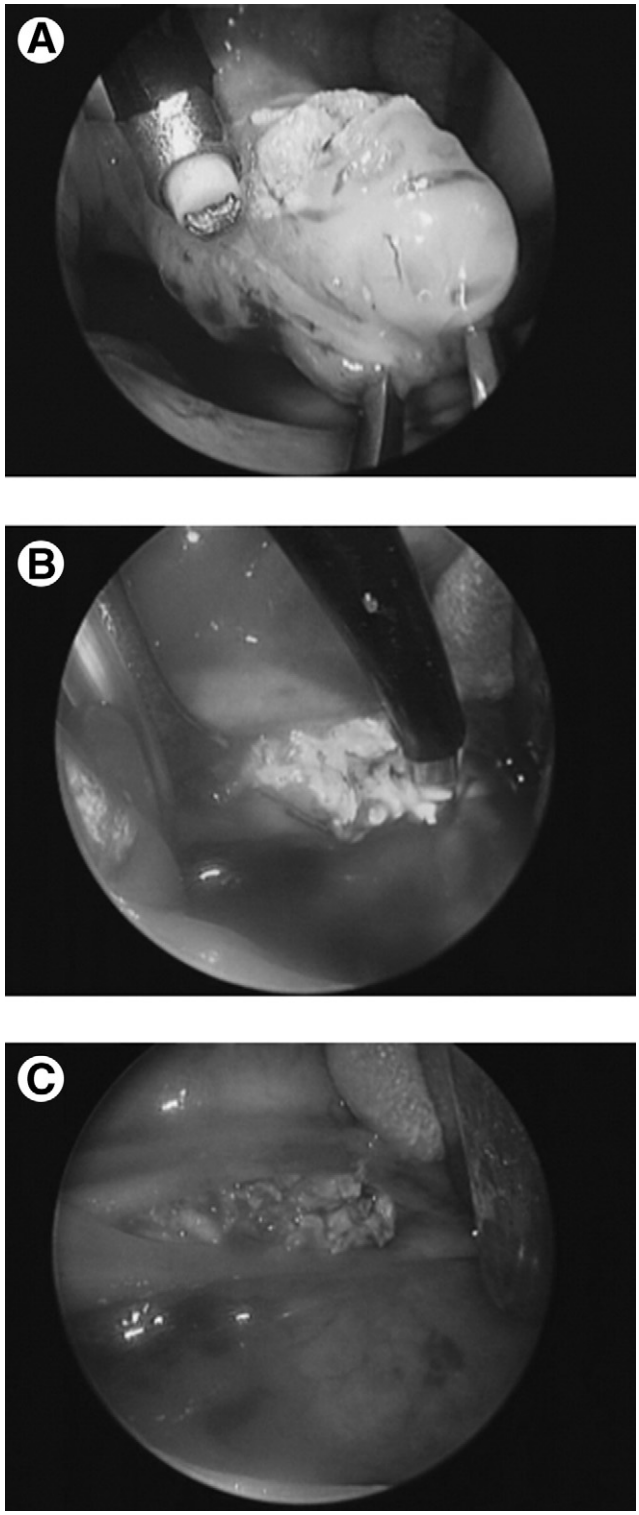

Figure 5 Partial tonsillectomy with coblation. (A) "Lop-off" technique. (B) Tissue reduction. (C) Final appearance. Figure used with permission from The Nemours Foundation.

inferior, the tonsil is dissected out leaving a hemostatic fossa.

jPK tonsillectomy

The tonsil is retracted medially and rotated to maximize exposure. Dissection can be started at the superolateral margin where the tonsillar capsule can be identified using the jPK on cutting. The tonsil is generally removed from superior to inferior. During dissection, known areas of higher vascular density may be "precoagulated" and sealed before vessel disruption to aid in hemostasis. The energy mode for precoagulation is changed to coag and applied for short 2- to 3-second bursts. This is then alternated with cutting mode. As the dissection proceeds inferiorly, the lack of capsule inferiorly can present a less defined area of lingual compared with the palatine tonsil. The curvature of the blade assists in the dissection, while continuing the alternating cut and coag to maintain hemostasis on the inferior vascular belt.

After excision, the tonsillar fossa is gently abraded with an instrument to unmask any potential bleeding vessels. It may be beneficial to release the mouth gag for 30 seconds and then re-evaluate. Further hemostasis is achieved with the monopolar suction cautery.

Adenoidectomy

Microdebrider

Adenoidectomy technique is similar to tonsillectomy using the microdebrider, irrespective of whether hemostatic current is used or not. The authors generally begin debridement at the choanae and move from cephalad to caudad, right to left. Depth of debridement should leave an approximately 2-mm thickness of adenoidal tissue, to prevent injury to the prevertebral fascia and musculature, and to reduce postoperative neck pain and torticollis. An inferior "hedgerow" of adenoid tissue 2-4 mm thick and 2-3 mm in height is maintained to prevent postoperative VPI. The tori tubarii must be protected throughout by angling the open cutting blade medially and protecting the tori with the closed metallic "back side" of the microdebrider. Suspicion of neoplasia mandates optimal histopathologic analysis, which should be obtained by cold curettage or forceps removal of larger adenoid fragments. Hemostasis may be achieved by packing the nasopharynx with dry tonsil sponges and then by suction electrocautery.

Coblation adenoidectomy

Coblation adenoidectomy is achieved by allowing saline to pool in the nasopharynx by hitting "ablate" without touching tissue, at power settings of 9 for ablate and 5 for coag, so that when tissue is touched in a gentle, slow, brushing technique from inferior to superior, and then right to left for the right-handed dominant surgeon, ablation occurs hemostatically under water. Minimal wand bending is required on occasion to reach choanal tissue when a C-shaped mouth gag is used (Figure 1). Less bending of the wand prevents clogging. Strong bilateral transnasal nonlatex catheter elevation of the soft palate prevents soft palate injury. An inferior ledge of tissue (2 mm) is left to prevent postoperative VPI.

Care should be taken not to allow tissue to contact the metallic unsheathed end of the wand tip. This is prevented by careful exposure and visualization.

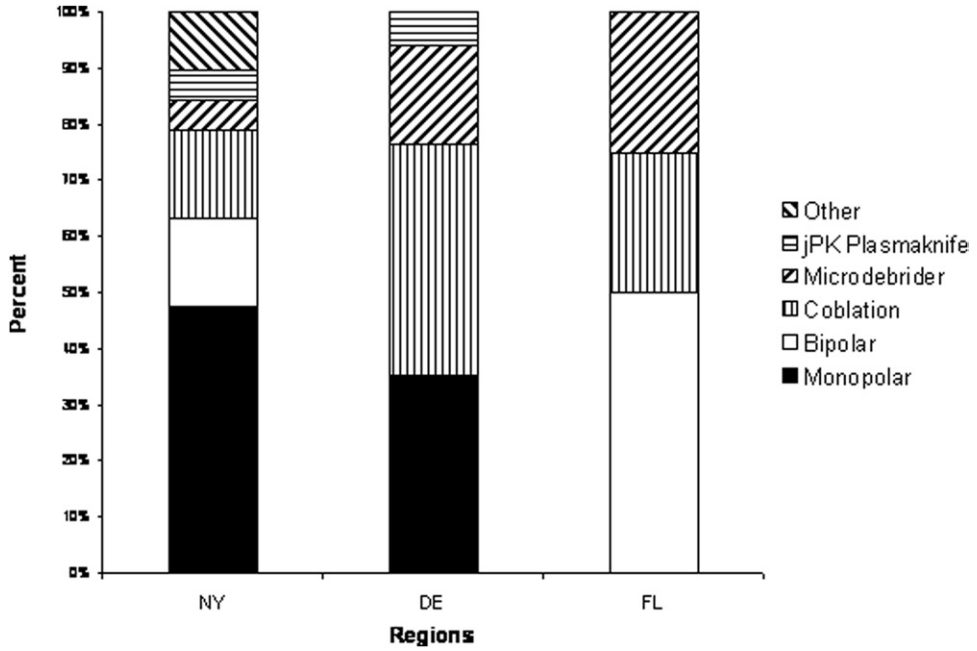

Figure 6 Device use prevalence.

Plasmacision adenoidectomy

The jPK shaft is bent gently, to not more than 60°, so the tip points upward toward the soft palate. Mild pressure is used to reduce the tissue. Choanal tissue may be removed by bending the device in the opposite direction so the tip of the J faces downward and tissue is removed on coag. Additional hemostasis can be achieved using tonsil sponges or electrocautery.

Device use and selection

Prevalence of device use

Who uses what, when, and for whom? Data accumulated from anonymous audience response surveys during lectures by the senior author in New York, Delaware, and Florida were consistent with data reported previously.[7] Of 40 total respondents, we found that approximately 28% of surgeons use primarily monopolar techniques for tonsillectomy, 22% use bipolar instruments, 27% use coblation, 16% use microdebriders, and 4% use the jPK, whereas 4% use other means (Figure 6). According to the American Academy of Otolaryngology–Head and Neck Surgery, the surgeon should determine the best procedure for each individual patient using their own judgment based on the specific patient presentation before them.[8] It therefore behooves surgeons to understand the indications and technical aspects of the various procedures, and to either learn the technique and technology or know of an appropriate colleague to whom the patient may be referred.

Technique and device selection

The broadly trained surgeon has options across the spectrum of thermal effect and degree of tonsillar removal—from cold to electrocautery complete tonsillectomy and from microdebrider to coblation partial tonsillectomy. The authors recommend partial procedures for most patients irrespective of whether performed by microdebrider or by coblation,[5,6,9,10] given improved recovery and reduced complications According to Schmidt and coworkers,[11] the low rate of regrowth and the need for reoperation for children with cold microdebrider tonsillectomy supports partial tonsillectomy for obstruction and infection. Longer-term studies are recommended because of the multifactorial nature of sleep apnea refractory to T&A in adult. Device selection should be based on the surgeon's skill set and judgment. The authors generally prefer the microdebrider for larger tonsil and adenoid sizes with suction electrocautery for hemostasis, given the greater likelihood of clogging with coblation for larger volumes of tissue reduction, particularly for infected tissue in teenage patients. Children with coagulopathy might benefit from coblation or suction electrocautery reduction of adenotonsillar tissue and/or laser techniques if these are available. Nonsurgical management, such as the use of positive airway pressure, should be discussed preoperatively as an option to surgery. This is particularly important in patients with severe medical comorbidities.

Conclusions

Appreciation of the indications and techniques for use of new T&A techniques and technologies, as well as an awareness of the economic ramifications of their adoption, will ultimately provide the best care for children. Laboratory, surgical, and simulation experience may provide for a safe starting point for learning new approaches to these common surgical procedures.

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