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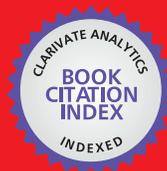
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A Review of Tonsillectomy Techniques and Technologies

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1. Introduction

1.1 Anatomy

The circular band of lymphoid tissue within the pharynx consisting of the adenoids, the palatine tonsils (Figure 1), and lingual tonsils is known as Waldeyer's ring. The palatine tonsils are lymphoid tissue with prominent germinal centers and the palatine tonsils, in contrast to the lingual tonsils and adenoids, have a distinct capsule¹which separates the tonsils from the lateral pharyngeal walls. The tonsil lies within a bed of three muscles that make up the tonsillar fossa. Forming the anterior pillar is the palatoglossus muscle and the posterior pillar is the palatopharyngeus muscle, while the superior constrictor muscle makes up the bed of the fossa. Medially, the tonsil crypts lay exposed to the oropharynx with specialize stratified squamous epithelium.

The tonsils are well vascularized with the majority of the blood supply arising from the tonsillar branch of the facial artery.¹The nerve supply of the tonsils arise from the ninth cranial nerve and descending branches from the lesser palatine nerves and the tympanic branch of CN IX is thought to account for the referred ear pain found in some cases of tonsillitis. The tonsils have no afferent lymphatic vessels. Their efferent lymph drainage is through the upper cervical nodes, especially to the jugulodigastric group. Tonsils and adenoids are immunologically most active between the ages of 4 and 10 years, and tend to involutes after puberty.²



Fig. 1. Orophaynx with Palatine Tonsils.

1.2 Indications for tonsillectomy

1.2.1 Absolute³

1. Obstructive sleep apnea
2. Cardiopulmonary complications secondary to airway obstruction (e.g., cor pulmonale, alveolar hypoventilation)
3. Suspected malignancy (asymmetric Tonsillar Hypertrophy) ⁴
4. Hemorrhagic tonsillitis
5. Tonsillitis causing febrile seizures

1.2.2 Relative³

1. Recurrent acute tonsillitis meeting one or more of the following criteria:
 - Seven episodes in 1 year
 - Five episodes/year for 2 consecutive years
 - Three episodes/year for 3 consecutive years
 - Two weeks of missed school or work in 1 year
2. Chronic tonsillitis refractory to antimicrobial therapy
3. Tonsillolithiasis with associated halitosis and pain, unresponsive to conservative measures
 - Peritonsillar abscess
 - Dysphagia due to tonsillar hypertrophy.

The indications for tonsillectomy have dramatically changed and are today more clearly defined. Geographical variations in the incidence of tonsillectomy are recognized and, although most of this variation may only reflect varying attitudes between physicians, there is little doubt that geographical variations in pathology are partly responsible⁵. In adults, the most common indication is recurrent acute tonsillitis⁵. However the most common indication in children is obstructive sleep apnea. Patients with a prior history of recurrent tonsillitis and prior peritonsillar abscess may be more likely to develop another peritonsillar abscess and are candidates for tonsillectomy.

2. History

Tonsillectomy has been performed by otolaryngologists, general surgeons, family practitioners and general practitioners. However, in the past 30 years the recognition for the need of standardization of surgical technique resulted in a shift in practice patterns so that it is almost exclusively performed by the otolaryngologists.

The first known removal of tonsils dates back to the first century AD, when Cornelius Celsus in Rome used his own finger to perform it⁶. The earliest description of the procedure was by Paul of Aegina in 625. The early instruments that were used for tonsillectomy were actually first developed for removal of the uvula. Phillip Syng invented what would become the forerunner for the modern tonsillotome. Not until the mid 18th century did Caque of Rheims perform tonsillectomies on a regular basis. Since then several different techniques have been used for tonsillectomy.

However, the difficulties encountered by surgeons, especially in controlling the perioperative bleeding, were a major drawback. It was only 1909, when Cohen adopted suture ligation of bleeding vessels to control the hemorrhage, that tonsillectomy became a common practice in hospitals⁷.

Sixty years later Haase and Noguera⁸, introduced the use of diathermy and the concept of electro-dissection was first described by Goycolea⁶ in 1982 using monopolar diathermy.¹⁰ years later Pang⁹ reported the first electro-dissection tonsillectomy using the bipolar forceps technique.

3. Preoperative evaluation

Adequate history and physical examination are essential in the preoperative diagnosis and evaluation of the patient being worked up for tonsillectomy. History alone is the most common method for diagnosing obstructive sleep apnea.¹⁰ When the diagnosis is at all in question, the child is younger than 2 years, or there is concern about the severity of the sleep apnea, a polysomnogram should be recommended.¹¹ Preoperative electrocardiogram and chest x-ray are not necessary unless there is a history of heart disease.¹² Other preoperative evaluation needs to be decided based on the medical conditions of each individual patient. For example, a child with von Willebrand disease should have the input of a hematologist regarding the use of desmopressin to minimize the risk of bleeding during the intraoperative and post-operative periods.

4. General technique

4.1 Exposure

For a successful surgery, adequate exposure, of the oro-pharynx must be achieved. Also knowledge of the relevant anatomy and tissue tension is important. With the aid of a mouth gag, e.g, Boyle -Davis (Figure 2), the oropharynx is exposed. 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.¹³



Fig. 2. Open-sided mouth gag (Davis Mouth Gag).

4.2 Surgical procedure

The method anesthesia induction and patients' positioning is similar for most patients undergoing tonsillectomy, regardless of which technique is used to remove the tonsils. The patient is placed in the supine position and orally intubated. The endotracheal tube is taped to the patient's chin in the midline. Alternatively, some practitioners prefer to use a laryngeal mask airway.^{14,15} The bed is turned 90°-180° so that the surgeon can sit or stand at the head of the bed. The patient is positioned at the edge of the bed, and a small shoulder roll is placed. Either a Crowe-Davis, McIvor, or Dingman mouth gag is inserted and expanded to keep the mouth open for the duration of the procedure. Tissue tension during complete tonsillectomy is achieved by strong medial traction of Allis clamps and torsion of the tonsils medially (Figure 3).

The tonsils are then removed using 1 of the techniques described later.



Fig. 3. Medial Traction on the Tonsil.

5. Patients and methods

50 patients (30 males, 20 females) were studied. 28(56%) had adenotonsillectomy, while 22(44%) had only tonsillectomy alone. The data was obtained by the author from three centres: University of Ilorin teaching hospital, Kwara state, IBB specialized hospital Minna, Niger state and Federal medical centre, Azare, Bauchi state.

35(70%) of the surgeries were performed using cold surgical dissection technique, while 15(30%) were done using bipolar electrocautry. All the surgeries were performed by one of two experienced surgeons. All the children were kept overnight; some were discharged the following day after they can tolerate liquid diet. Routine antibiotics and analgesics were given to all the patients.

For the 28 patients who had adenotonsillectomy, the mean operating time for the 8 bipolar electrocautries was 42.0 minutes and 47.2 minutes for the 20 cold dissection patients.

For the 22 patients who had tonsillectomy alone, the mean operating time was 31.4 minutes for the 7 bipolar electrocautries, while 34.2 minutes for the 15 cold dissections.

Complication of hemorrhage were seen in 3(6.0%) of all the patients, 2(66.7) were in cold dissection group and 1(33.3%) in bipolar electrocautry group.

6. Techniques and technologies

The techniques of Tonsillectomy can be broadly divided into 2 major categories: extracapsular (total tonsillectomy, subcapsular) and intracapsular (partial tonsillectomy). Intracapsular is also known as “subtotal,” and this procedure is referred to as tonsillotomy in some literatures. Extracapsular tonsillectomy involves dissecting lateral to the tonsil in the plane between the tonsillar capsule and the pharyngeal musculature, and the tonsil is generally removed as a single unit. 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.¹⁶ 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.^{17,18} The most common extracapsular techniques use a “cold” knife (sharp dissection), monopolar electrocautery, bipolar cautery (or bipolar scissors), or harmonic scalpel. Intracapsular techniques may use the microdebrider, bipolar radiofrequency ablation (which can also be used to remove the entire tonsil), and carbon dioxide laser. Either extracapsular or intracapsular tonsillectomy can be performed for the pediatric patient with obstructive sleep apnea, but only extracapsular techniques should be used for patients undergoing tonsillectomy as a result of tonsillitis or peritonsillar abscess. In addition, tonsils can be ablated using a laser or monopolar radiofrequency (somnoplasty) in a cooperative adult in a clinic setting.

7. “Cold” knife

A frequently used method for total tonsillectomy is the “cold” or sharp dissection technique. In this technique, the tonsil and capsule are dissected from surrounding tissue using scissors, knife, or tonsil dissector (Figure 4) and the inferior pole is amputated with a tonsil snare.



Fig. 4. Tonsil Dissector.

8. Harmonic scalpel

The harmonic scalpel (Figure 5) can be used to perform an extracapsular tonsillectomy (Ethicon Endo-Surgery Inc, Cincinnati, OH). It uses ultrasonic energy to vibrate its blade at 55,000 cycles per second. The vibration transfers energy to the tissue, providing simultaneous cutting and coagulation, so, typically, no additional instrument is needed for haemostasis. The components of the device include a generator, a hand piece, and a disposable blade. A high-frequency power supply provides energy to the hand piece. The blade oscillations dissect tissues by creating intra-cellular cavities as pressure waves are conducted through the tissues. The expansion and contraction of these cavities results in the lysis of cellular connections, resulting in tissue dissection.

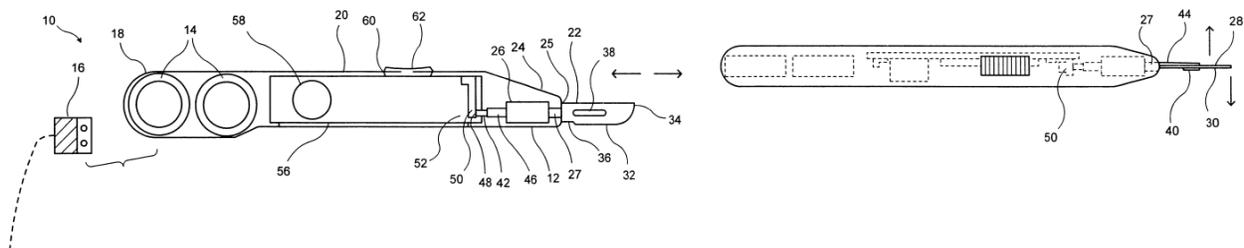


Fig. 5. Harmonic/ultrasonic scalpel.

9. Bipolar radiofrequency ablation

Bipolar radiofrequency ablation can be used to perform an extracapsular or intracapsular tonsillectomy; however, it is most commonly used to perform a partial tonsillectomy (Figure 6). The equipment includes a radiofrequency generator, foot control, saline irrigation regulator, and the coblation wand (PlasmaCare Corp, Sunnyvale, CA). During a bipolar radiofrequency ablation tonsillectomy, conductive saline solution is converted into an ionized plasma layer, resulting in molecular dissociation with minimal thermal energy transfer. Haemostasis can usually be performed with the coblation wand alone.



Fig. 6. Bipolar Probe.

10. Microdebrider tonsillectomy

This is another method for intracapsular tonsillectomy. The microdebrider is a powered rotary shaving device with continuous suction, made up of a tube, and connected to a hand piece, which, in turn, is connected to a motor with foot control and a suction device. A partial tonsillectomy is completed with the removal of approximately 90% to 95% of the tonsil, while preserving the tonsillar capsule.

11. Advantages and disadvantages of the techniques

There is great debate about the relative merits of the various tonsillectomy techniques published in many studies, with many more ongoing that compare the techniques. The existing literature consistently reports that the intracapsular (partial) techniques result in less postoperative pain, however, the degree of lessened pain continues to be much debated.^{19,20,21} In addition; there is a small risk of tonsil regrowth and the necessity for an additional procedure with the intracapsular techniques. Of the extracapsular techniques, “cold” tonsillectomy results in less postoperative pain compared with an electrocautery or “hot” tonsillectomy; however, the latter procedure is typically faster and has less intraoperative blood loss.^{22,23,24} Although not extensively researched thus far, a total tonsillectomy with the coblation unit may have slight advantages over electrocautery tonsillectomy.²⁵ The studies on outcomes of surgeries completed with the harmonic scalpel do not show any definitive advantage to the scalpel.^{26,27} It is not clear which technique, if there is one, results in the lowest rate of postoperative hemorrhage.^{28,29}

Most of the data available to date suggest that there is no difference in the bleeding rates between extracapsular and intracapsular tonsillectomy.³⁰ The equipment involved with various techniques varies in price, although the largest cost factor in any tonsillectomy is the operating time.

12. Postoperative care

A majority of children can safely be discharged home on the same day of surgery, regardless of the surgical technique used.^{10,30} Children younger than 2 years or who live far from a hospital should be kept overnight for observation. Pain medication should be recommended, and most physicians prescribe either acetaminophen or acetaminophen with codeine postoperatively.³¹ Some physicians recommend a soft diet postoperatively, others recommend “diet as tolerated.”¹⁰ In our centres we commence the child on firstly on cold ice cream and subsequently on liquid diet.

Studies have not shown any difference in recovery between children who have a restricted versus those who have non-restricted diets postoperatively.^{32,33}

13. Long-term follow-up

Typically, the patient will be seen in the office in 2 weeks, then 1 month of the tonsillectomy to confirm adequate healing, although it is also acceptable to follow-up with a phone call only.^{10,34}

14. Conclusions

Appreciation of the indications and the use of new tonsillectomy techniques and technologies, as well as an awareness of the economic ramifications of their adoption, will ultimately provide the best care for tonsillectomy patients.

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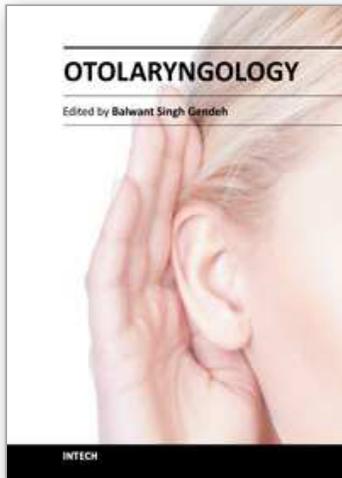
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