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Current reviews

Rethinking surgical technique and priorities for pediatric tonsillectomy☆

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ABSTRACT

The past 100 years have witnessed dramatic shifts in the concept of ideal surgical goals and operative technique in tonsil surgery. Surgeons are reviving a technique of intracapsular tonsillectomy with increasing precision thanks to modern technology. With intracapsular tonsillectomy, pediatric patients recover faster, use less pain medication, and have a lower risk of dehydration and hemorrhage. Various considerations will dictate the adoption of this technology in the coming years. This current review explores concepts and controversies surrounding tonsillectomy with a focus on quality improvement.

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The past 100 years have witnessed dramatic shifts in the concept of ideal surgical goals and operative technique in tonsil surgery. Rather than prevention of tonsillitis and its complications, obstructive sleep disordered breathing now ranks as the most common indication for pediatric adenotonsillectomy. As such, surgeons are reviving a technique of intracapsular tonsillectomy with increasing precision thanks to modern technology [1,2]. With intracapsular tonsillectomy, pediatric patients recover faster, use less pain medication, and have a lower risk of dehydration and hemorrhage postoperatively [3–6]. To date, adoption has been asymmetric across various countries, centers of excellence, and providers [1,7]. Intracapsular tonsillectomy is an important component of the armamentarium of the otolaryngologist, particularly when considering quality improvement and cost containment.

Prior to the twentieth century, partial tonsillectomy was the norm. Total tonsillectomy only gained favor after the advent of safer anesthetic techniques. In part responding to concerns about the complications of tonsillitis, total tonsillectomy was fully adopted in the United States by the mid-1900s. Electrocautery offered a means for intraoperative hemostasis and has become a predominant technique either primarily or as an adjunct to cold dissection. The outcomes of electrocautery tonsillectomy have been hampered by not-insignificant rates of postoperative hemorrhage and pain with associated dehydration [1,3,7,8]. Tonsillectomy and adenoidectomy remains among the most commonly performed pediatric surgeries in the United States [8]. The current tonsillectomy "rate" is estimated at 0.53 per thousand children and 1.46 per thousand children for combined tonsillectomy and adenoidectomy [9]. As such, the 21st century has seen the adoption of various technologies to replace cold steel and electrocautery including coblation, radiofrequency, and harmonic scalpel, though these have failed to provide significant improvements in pain [7].

Otolaryngologists have become accustomed to counseling their patients' families that "the next two weeks are going to be tough." Despite scheduled dosing of narcotic and/or non-narcotic pain medications, children continue to experience moderate pain following total tonsillectomy. Postoperative regimens are also hampered by caregiver noncompliance. Given unreliable metabolism of acetaminophen/codeine and its lack of superiority over acetaminophen alone, codeine has fallen out of favor. Systematic reviews have suggested the safety of NSAIDs (with the exception of ketorolac), but uncertainty remains with updated analyses unable to exclude an increased risk of bleeding [8,10,11]. At our institution, patients receive scheduled alternating suspensions of acetaminophen and ibuprofen every three waking hours with hydrocodone/acetaminophen to replace acetaminophen for treatment of "breakthrough" pain. Hydrocodone dosing is scaled down or eliminated in patients at high risk for respiratory complications.

Intracapsular tonsillectomy results in significantly less postoperative pain than total tonsillectomy. Hultcrantz et al. demonstrated patients

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undergoing CO2 laser tonsillotomy had complete resolution of pain three days earlier than patients undergoing traditional blunt dissection tonsillectomy [12]. In a randomized, double-blind, paired control study Lister et al. removed one tonsil by electrocautery and the contralateral by microdebrider intracapsular tonsillectomy in each patient. Children reported significantly less pain on the tonsillotomy side for the first 9 postoperative days. While 80% of the children reported otalgia, it was always unilateral and on the side of the electrocautery tonsillectomy [13]. The beneficial outcome of less pain, less analgesic use, and faster return to normal diet has been established by meta-analyses and well-designed studies [3–6,13–19].

Common theories regarding the physiology of decreased postoperative pain focus on preservation of a biologic dressing over the pharyngeal musculature as well as decreased thermal injury to the tissues [1,7,13,15,20]. Concern has been raised regarding tonsil bed visualization and blood loss using a microdebrider technique. Experience with the technique now allows surgeons more precision such that total cauterization time to the oropharynx averages 95 seconds. We use a local injection of bupivacaine with epinephrine to the superior pole and QuikClot for hemostasis such that residual fronds of tonsil tissue or discrete areas of bleeding can be accurately addressed with cautery. Children who undergo less cauterization recover more quickly and on average achieve complete recovery (normal diet, normal activity, and no narcotics) in 4.5 days [2]. When children recover faster with less discomfort, families can return to their normal lifestyle and productivity without distress.

When considering the success of a tonsillectomy, it is essential to consider the entire experience of the postoperative course, including any unplanned stressors. Imagine the frustrating process of struggling with a child who arrives at a point of dehydration requiring phone calls to the office, emergency department visits, and possible readmission. Schmidt et al. reviewed data from 2944 patients and identified a rate of ER evaluation for postoperative pain or dehydration of 3% for intracapsular tonsillectomy compared with 5.4% for total tonsillectomy [21]. Other retrospective studies have similarly favored intracapsular technique due to lower rates of re-admission for dehydration at only 0.4%–1.3% [22,23]. At Columbia/Cornell, the intracapsular group had a 0.3% rate of readmission or ED visit versus 8.3% in the total tonsillectomy group [24]. While some studies find readmission rates to be similar between the two techniques, data has not been encountered to support lower readmission rates in total tonsillectomy patients [3]. The psychological and financial impact of these postoperative events on families can be surmised but has yet to be studied.

Caring for a child with a post-tonsillectomy bleed is an unforgettable experience for the families and the provider. The experience of a life threatening complication for the parents and patient is not something that we can easily quantify. We typically counsel patients that, “if your child bleeds, it will not be subtle,” because indeed these events often require a trip to the ER and sometimes uncomfortable interventions. We recently cared for a young girl who experienced a secondary hemorrhage after electrocautery total tonsillectomy and underwent unsuccessful silver nitrate cauterization in the ER. She ended up heading to the OR holding area with a tonsil sponge holding pressure against her bleeding tonsillar fossa. She was a brave girl and had an uneventful postoperative course thereafter despite being shaken and mildly anemic. Such experiences should prompt the question: what is the impact on quality of life of a post tonsillectomy bleed relative to need for revision tonsillectomy years later?

Intracapsular tonsillectomy carries a lower rate of postoperative hemorrhage than total tonsillectomy. As a result, several European nations are shifting toward tonsillotomy and seeing improvements in perioperative statistics. In Austria, a 9 month prospective trial was performed to evaluate the bleeding rate in 3372 pediatric tonsillectomies. Hemorrhage occurred in 15% after total tonsillectomy compared with 2.3% after tonsillotomy, with 4.2% and 0.9% requiring an operation, respectively [25]. These patients underwent tonsil surgery for a variety of indications and bleeds were classified using a scale of 7 severity grades, perhaps capturing bleeding events that otherwise escape retrospective review. Using a national Swedish tonsil register, analysis of patients undergoing surgery for hypertrophy also showed lower late bleeding rates in intracapsular technique (0.8% versus 3.7%) [26]. Extensive reviews have echoed the improved safety profile of intracapsular technique and note its increasing utilization [4–6]. Given the low incidence of post tonsillectomy hemorrhage overall and variations in both reporting and surgical technique, smaller prospective trials are generally not powered to reveal these benefits. In the age of decreasing postoperative antibiotics and more liberal use of NSAIDs, these small differences may become more pronounced [27].

In the current medical environment, cost containment is paramount, and intracapsular tonsillectomy offers an opportunity to reduce the financial footprint. In a prospective, randomized, double blinded study, microdebrider intracapsular tonsillectomy was more cost effective than both intracapsular coblation and electrocautery tonsillectomy. Surgical time for tonsillectomy was shortest with the microdebrider (16 min), and the device was less expensive than the coblation wand [18]. Some institutions have seen slightly increased surgical time for the microdebrider, but we anticipate this difference will decrease with experience [28]. At our institution, surgical time for adenotonsillectomy averages 19.8 min with the microdebrider [2]. Reduction in PACU time, ER visits, unplanned re-admissions, narcotic use, and postoperative complications further contribute to potential cost savings [15,24]. Intracapsular tonsillectomy is proving safe to perform in young patients in an ambulatory fashion [29]. We anticipate further research will uncover unmeasured financial considerations in which caregivers are returning to work sooner and resting better at night allowing for a more productive workday.

Intracapsular tonsillectomy has recently been reclassified as either Class 1 (tonsillotomy) or Class 2 (partial/subtotal/intracapsular tonsillectomy). In a Class 1, the tonsillar pillars are used as a landmark for removing the protruding portion of the tonsil. Class 1 is the common procedure in Sweden and accounts for 64% of tonsil surgery nationwide [26]. In a Class 2 procedure, an attempt is made to remove most of the tonsil tissue. Comparisons between the two types of tonsillectomy have not yet been made though they appear to exhibit similar safety profiles [6,30].

Class 2 using a microdebrider is the technique of choice at our institution (the microdebrider is also our preferred modality for performing adenoidectomy) with the cost of the microdebrider disposable blade approximately $100. All children undergoing removal of the tonsils by the author without a significant history of recurrent pharyngitis have a Class 2 procedure, though some studies have suggested that recurrent pharyngitis should not contraindicate this technique [6,31]. In fact, a recent clinical practice guideline argues in favor of utilization of intracapsular tonsillectomy for recurrent tonsillitis, citing efficacy in the face of improved postoperative morbidity [32]. Still, many practitioners remain concerned about adoption of intracapsular tonsillectomy due to concerns about recurrent tonsillitis, peritonsillar abscess, or non-resolution of obstruction post-operatively.

Intracapsular tonsillectomy is as efficacious as total tonsillectomy and is durable in the vast majority of patients. After six year follow up for children aged 9–15 randomized to CO_2 tonsillotomy versus total tonsillectomy for sleep disordered breathing, there was no difference between the groups in rates of infection or snoring [33]. Effectiveness has been demonstrated in children with severe obstructive sleep apnea as measured by polysomnogram with the average obstructive apnea hypopnea index decreasing from 25.5 to 3.9 [34]. The technique remains efficacious in younger and older pediatric populations [35–37]. Regrowth rates are low, estimated at 0.5%–6.1%, with a low proportion of these patients actually needing reoperation for infection or obstruction [22,38–40]. In fact, new research is suggesting that the rate of symptomatic adenoid regrowth is higher in patients undergoing total tonsillectomy (1.4% vs. 0.06%) [41]. At our institution we do not currently offer intracapsular tonsillectomy to children with bona fide