Systematic Review of Complications of Tonsillotomy versus Tonsillectomy
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What is This?
Systematic Review of Complications of Tonsillotomy versus Tonsillectomy

Jason L. Acevedo, MD1,2, Rahul K. Shah, MD3,4, and Scott E. Brietzke, MD, MPH2,5

No sponsorships or competing interests have been disclosed for this article.

Abstract

Objective. Intracapsular tonsillotomy continues to gain acceptance as an alternative to traditional tonsillectomy. Despite large clinical studies, there is a lack of consensus as to which technique offers lower complication rates. This study seeks to analyze the available data and surmise the complication rates of partial tonsillectomy as compared with traditional tonsillectomy.

Data Sources. MEDLINE was searched using multiple search terms.

Review Methods. After the MEDLINE search, the following inclusion criteria were applied: English language, human subjects, and related to partial tonsillectomy. Multiple tonsillotomy techniques were included. The results of these studies were summated and the results analyzed. Subgroup analysis was then performed.

Results. Thirty-three studies met inclusion criteria. Tonsillotomy had a lower postoperative bleeding rate, lower postoperative dehydration rate requiring medical care, reduced days of analgesic use, and reduced days to return to normal diet compared with tonsillectomy. When separated into higher versus lower quality studies, the differences in bleeding and dehydration were negligible, while differences in return to diet and days of analgesic use persisted. Mean intraoperative blood loss was similar for both techniques. Insufficient data were available to assess tonsil regrowth rates.

Conclusions. Tonsillotomy appears to be a safe technique that may offer some advantages over tonsillectomy in terms of postoperative morbidity, but differences in hemorrhage and dehydration were not evident in high-quality studies. Data regarding tonsil regrowth rates and efficacy in treating sleep-disordered breathing are not yet sufficient for formal analysis, which may preclude widespread acceptance of this technique.

Keywords

tonsillotomy, partial tonsillectomy, sleep-disordered breathing, evidence-based medicine

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searched using multiple search terms. The search period included was from October 2010 until December 2011. No other databases were included. The specific search terms used were *intracapsular* and *tonsillectomy*, *partial and tonsillectomy*, and *tonsillectomy*. The following inclusion criteria were then applied: English article, human subjects, and related to complications and morbidity of partial tonsillectomy. No age criteria were applied. Studies that directly compared tonsillectomy and tonsillectomy were included, as well as those that described tonsillectomy only. There were no internal control patient studies (studies in which one tonsil was removed via tonsillectomy and the other via tonsillectomy). Both randomized and observational studies were included. Planned and retrospective observational studies were included. Articles that did not include discreet metrics were excluded (no mention of days of analgesia, blood loss in cc’s, etc.). Manual checks were performed of the bibliography of each article. Multiple tonsillectomy techniques (microdebrider, coblation, laser, cautery, cold steel, and bipolar scissors) were included, as the goal was to assess the technique of tonsillectomy rather than the technology used to perform it. The results of these studies were summarized in an evidence table and analyzed with primary outcome measures of postoperative bleeding rate and rate of dehydration requiring medical care. Secondary outcome measures included days of use of analgesics (days), days to return to normal diet (days), and estimated intraoperative blood loss (measured in cubic centimeters [cc]). Subgroup analysis was then performed with the same outcomes comparing the 2 most frequent types of instrumentation for tonsillectomy: microdebrider and coblation. The data were extracted by 2 reviewers independently, with a third reviewer used to settle any discrepancies. All studies enlisted a minimum of 10 patients. Prospective controlled studies, case-control studies, case series, and retrospective reviews were included. The 2 senior authors independently assessed the articles for eligibility, and the lead author abstracted data from the articles.

A quality assessment was performed on the included articles by assessing the following metrics: data collection (prospective versus retrospective), randomization (randomized design versus not), blinding (blinding versus unblinded), and loss to follow-up (greater than 10% versus less than 10%). These factors are described in Table 1.

Statistical analysis was performed with statistical software (STATA 8.2, College Station, Texas). Random effects modeling was used to calculate summary effect measures (risk ratio and risk difference) with corresponding 95% confidence intervals, and Forest plots were generated. The 1^2 statistic was used to assess between-study heterogeneity. Risk ratios and risk differences (tonsillectomy–tonsillectomy, resulting in a positive number favoring tonsillectomy and a negative number favoring tonsillectomy) were generated comparing tonsillectomy to tonsillectomy. Subgroup analysis was performed between coblation and microdebrider tonsillectomy techniques, but sparse data prevented definitive conclusions. A P value of less than .05 was considered significant.

**Results**

**Literature Search**

Using the aforementioned search criteria, 260 articles were initially identified. Thirty-three studies met inclusion criteria (Figure 1). Those reporting on the primary outcome measures of bleeding rate, dehydration rate requiring medical care, intraoperative blood loss, days of analgesic use, and days to return to normal diet are detailed (Tables 2 and 3). Thirteen studies were randomized controlled trials (level 1, Center for Evidence Based Medicine, www.cebm.net), 4 were cohort studies (level 2), 3 were case-control studies (or nonconsecutive cohort studies, level 3), and 13 were case series (or retrospective case-control studies, level 4). The mean number of subjects in each study was 564 (range, 24-2943; median, 101), with the mean number of tonsillectomy patients being 275 (range, 12-1731; median, 50) and tonsillectomy patients being 287 (range, 12-1289; median, 49). The mean age of all patients (in studies where it was noted, k = 28) was 7.1 years (range, 17 months to 65 years), with tonsillectomy patients averaging 6.7 years and tonsillectomy patients averaging 7.5 years (k = 15). The average length of follow-up was 5.06 months (k = 25).

**Random Effects Modeling of Primary Outcome Measures**

Random effects modeling was performed to estimate summary effect measures comparing tonsillectomy to tonsillectomy for the outcomes of postoperative bleeding rates, dehydration requiring medical therapy rates, days to return to normal diet, days of analgesic use, and intraoperative blood loss. Risk ratios comparing rates of postoperative bleeding and dehydration rates were calculated from studies directly comparing the 2 tonsil removal techniques. The risk ratio of postoperative bleeding of tonsillectomy versus tonsillectomy was 0.29 (k = 18 studies, 95% confidence interval [CI] = 0.211-0.401, P < .001; see Figure 2), significantly favoring tonsillectomy. The risk ratio for dehydration requiring medical care was 0.45 (k = 10 studies, 95% CI = 0.339-0.601, P < .001; see Figure 3), also favoring tonsillectomy. Tonsillectomy patients also had a shorter duration to return to normal diet (difference of 2.25 days, 95% CI = 1.133-3.376, P < .001, 1^2 measure of heterogeneity = 99.9%) and fewer days of analgesic use (2.50 days, 95% CI = 2.090-2.907, P < .001, 1^2 = 99.9%). There appeared to be no clinically significant difference in intraoperative blood loss (difference of 1.69 cc, 95% CI = –3.998 to 7.373, P = .561, 1^2 = 99.9%; see Table 4).

**Subgroup Analysis: Coblation versus Microdebrider**

Subgroup analysis was performed based on the surgical instrumentation used for the surgery. There were sufficient data only to compare microdebrider and coblation. The data for tonsillectomy versus tonsillectomy, stratified by instrumentation, are shown in Table 4. Although the data in some cells are sparse, a brief analysis of the trends suggests the difference between tonsillectomy and tonsillectomy may be driven largely by the differences in using the coblation.
<table>
<thead>
<tr>
<th>Study</th>
<th>Technique</th>
<th>Sample Size</th>
<th>Location</th>
<th>Age, y</th>
<th>Indications</th>
<th>Allocation</th>
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<th>Blinded Loss to Follow-up, %</th>
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<td>Nonrandom</td>
<td>Prospective</td>
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</table>

Abbreviations: CK, cold knife tonsillectomy; CT, coblation tonsillectomy; ET, electrocautery tonsillectomy; LT, laser tonsillectomy; MT, microdebrider tonsillectomy; OSA, obstructive sleep apnea; RFA, radiofrequency ablation; SDB, sleep-disordered breathing; TT, total tonsillectomy.
instrumentation, as the differences between tonsillotomy and tonsillectomy using microdebrider were not as pronounced. Unfortunately, insufficient data prevented a more formal analysis of this hypothesis.

Quality Assessment and Sensitivity Analysis

Study design and quality among the included studies was highly variable. Of the 33 studies, 20 were prospective studies (61%). Twelve of the 20 prospective studies were randomly allocated (60%), with 8 being single blinded and 4 being double blinded (when the operative surgeon was informed of the technique to be used at the time of surgery). Eight of the 20 prospective studies (40%) reported loss to follow-up of greater than 10%. Therefore, an objective quality assessment was undertaken to ascertain the possible effect these factors could have had on the results. Ideally, the effects of prospective design, randomization, blinding, and follow-up variations would be assessed individually. However, as might be expected, many of these factors were clustered such that most prospective studies were also randomized and blinded, somewhat limiting the analytic possibilities. Thus, the prospective randomized, blinded studies (ie, higher quality studies) were compared with the remaining (lower quality) studies (Table 5). Interestingly, the random effects model summary estimates of the risk ratios for postoperative hemorrhage and postoperative dehydration requiring medical care were nonsignificant for the higher quality studies. Conversely, the lower quality studies continued to show a robust difference between the 2 techniques. The final interpretation of this is left to the reader, but one possible explanation is that a higher quality study design that is less prone to bias and error shows the difference between tonsillectomy and tonsillotomy to be minor and nearly insignificant. For the additional outcomes of days to return to normal diet, days of pain medicine usage, and intraoperative blood loss, there was no significant difference between the higher and lower quality studies.

One study by Schmidt et al5 had by far the largest sample size (n > 2900) of any study in the data set. A sensitivity analysis was undertaken to assess the possibility that the findings from this study were disproportionately affecting the overall results of this meta-analysis. Therefore, the appropriate analysis was repeated with and without inclusion of this study in the data set. When this study was excluded, the results were as follows. The risk ratio for postoperative hemorrhage changed only slightly from 0.30 (95% CI = 0.220-0.422) to 0.29 (95% CI = 0.195-0.443). The risk ratio for postoperative dehydration requiring medical care also changed only slightly from 0.49 (95% CI = 0.365-0.649) to 0.37 (95% CI = 0.229-0.609). Considering the 95% CIs, these changes were judged to be insignificant. The secondary outcomes did not involve data from the Schmidt et al study.

Discussion

The purpose of this study was to compare postoperative morbidity of tonsillotomy versus tonsillectomy. The results of this study demonstrate that when comparing tonsillotomy to tonsillectomy, postoperative hemorrhage, medical intervention for dehydration, return to diet, and usage of analgesics were all lower by statistically significant margins. On the basis of subgroup analysis, it also appears possible that the coblation technique confers more of an advantage than the microdebrider in terms of postoperative complications.

As with any meta-analysis or systematic review, this study is limited by the heterogeneity of the data. Multiple tonsillotomy and tonsillectomy instruments were included, as well as a multitude of surgeons (presumably at different levels of training). Much of the data regarding pain was not included in this study because of heterogeneity. The authors’ attempt in this study was to focus on objective outcomes (ie, blood loss, hemorrhage, visits for dehydration, and days of analgesic use). In addition, many of the studies included were retrospective and subject to the inherent bias of this type of study. An additional limitation was that none of these studies were explicitly designed to study the complications noted in this article, and most of those described were secondary outcomes. Finally (although some studies were self-classified double blinded), no study blinded the surgeons as to the allocation, which could potentially introduce bias by favoring a preferred technique.

The results of the quality assessment also are of interest. A wide variety of studies were included, and random effects modeling seemed to demonstrate that higher quality studies showed a less pronounced benefit as compared with lower quality studies. This may be secondary to the biases in the lower quality studies. In fact, the higher quality studies

Figure 1. Search methodology.
seemed to suggest there was little if any difference in postoperative hemorrhage or dehydration rates (differences in postoperative analgesic use and return to diet were present in both groups). In addition, the calculations of heterogeneity in this review were extremely high, which would call into question any potential differences appreciated between the tonsillectomy and tonsillotomy groups.

Although this study demonstrates advantages of tonsillotomy over tonsillectomy in postoperative morbidity, important questions remain unanswered. The great majority of pediatric tonsillectomy procedures are performed for the indication of sleep-disordered breathing (SDB). Tonsillectomy has been demonstrated to be an effective, although not perfect, initial technique for the management of SDB. Yet as the physiology of upper airway obstruction is unquestionably complex, partial removal of the tonsil may not address the obstruction to the same level as complete removal of the tonsil. This question should be adequately addressed with appropriate studies including objective polysomnography results to clearly demonstrate the effectiveness of tonsillotomy in the treatment of SDB. Only limited data have been presented to date. In addition, several studies were excluded because of the subjectivity of pain assessment. Future studies may consider using standardized metrics for describing pain related data to facilitate macro-level studies.

One of the key questions that remain is the rate of regrowth and the need for completion surgery with tonsillotomy. As pointed out by Koemple et al,1 tonsillotomy was the most commonly employed technique until the 1930s, and regrowth was not widely reported by surgeons of this era. A longitudinal study to assess the rate of this

### Table 2. Evidence Table Detailing Postoperative Complications

<table>
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<tr>
<th>Study</th>
<th>Year</th>
<th>Technique</th>
<th>Patients</th>
<th>Postoperative Hemorrhage</th>
<th>Dehydration</th>
<th>Revisits</th>
<th>Patients</th>
<th>Postoperative Hemorrhage</th>
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**Abbreviation:** RFA, radiofrequency ablation.

*aDenotes studies using multiple instruments that were separated for purposes of subgroup analysis.*
### Table 3. Evidence Table Detailing Return to Diet, Days of Analgesic Use, and Estimated Blood Loss (EBL)

<table>
<thead>
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<th>Study</th>
<th>Year</th>
<th>Technique</th>
<th>Patients</th>
<th>Return to Diet</th>
<th>Days Using Analgesics</th>
<th>EBL</th>
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<th>Days of Analgesics</th>
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<sup>a</sup>Denotes studies using multiple instruments that were separated for purposes of subgroup analysis.

**Figure 2.** Forest plot of included studies demonstrating risk ratio for postoperative bleeding for tonsillotomy versus tonsillectomy. Risk ratio < 1 favors tonsillotomy.
complication would be of utility. While there is a paucity of data regarding the rates of regrowth for tonsillotomy, several studies have been published on such topics. Sorin et al.\textsuperscript{4} reported a regrowth rate of 3.2% (n = 278), while Schmidt et al.\textsuperscript{5} in a very large series reported a revision rate of 0.8% (n = 1373 patients). In contrast, Celenk et al.\textsuperscript{35} reported a regrowth rate of 16.7% and a revision surgery rate of 11.9% (n = 42), but with a very small sample size. The wide variation in rates reported suggests that further research would be of utility. Given the trends in tonsillectomy, with overall increasing numbers and a gradually decreasing mean age, the potential effect of age at the time of tonsillotomy (with regard to regrowth rate) should be adequately addressed prior to widespread acceptance of tonsillotomy over tonsillectomy. Future longitudinal studies to determine the ideal range of follow-up (time frame for regrowth) and the overall rate of regrowth (especially in younger children) would help delineate the utility of tonsillotomy. Although the goal of

**Figure 3.** Forest plot demonstrating risk ratio for postoperative dehydration requiring medical care for tonsillotomy versus tonsillectomy. Risk ratio <1 favors tonsillotomy.

**Table 4. Differences in Outcomes between Tonsillectomy and Tonsillotomy**

<table>
<thead>
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<tr>
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<td>1.133-3.376</td>
<td>0.202-3.233</td>
<td>1.664-4.276</td>
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<td>3</td>
</tr>
<tr>
<td>I\textsuperscript{2} measure, %</td>
<td>99.9</td>
<td>99.9</td>
<td>99.9</td>
</tr>
<tr>
<td>Number of days requiring pain med use</td>
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<td>95% CI</td>
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<td>&lt;.001</td>
<td>&lt;.001</td>
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<tr>
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<td>99.9</td>
<td>99.9</td>
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<tr>
<td>Estimated intraoperative blood loss, cc</td>
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</tr>
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<td>-14.928 to 0.278</td>
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<td>99.9</td>
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\textsuperscript{a}Differences calculated (tonsillectomy outcome subtracted from tonsillotomy outcome) such that a positive number favors tonsillotomy over tonsillectomy and a negative number favors tonsillectomy versus tonsillotomy.
this study was to better delineate the complication rates of tonsillotomy as related to tonsillectomy and provide an answer to this question, there is not currently enough data as to the long-term complications and efficacy rates to adequately define the role of tonsillotomy. Despite this, this study appears to confirm that with regard to morbidity and postoperative complications, tonsillotomy offers an option with a lower hemorrhage rate, fewer revisits for dehydration, less use of analgesics, and faster return to diet, with comparable intraoperative blood loss.

**Conclusion**

Tonsillotomy may be advantageous over tonsillectomy in objective measures of postoperative morbidity (less analgesic use and faster return to diet) but may offer little advantage with regard to reductions in postoperative hemorrhage and dehydration rates. Intraoperative blood loss appears to be comparable. Key questions of objective effectiveness in the treatment of SDB and the possibility of tonsil regrowth in young children with extended follow-up remain to be addressed.

**Disclaimer**

The opinions and assertions of the authors contained herein are the private views of the authors and are not to be construed as reflecting the views of the Department of Defense or the Department of the Army.

**Author Contributions**

Jason L. Acevedo, conception, design, acquisition of data; Rahul K. Shah, critical revision; Scott E. Brietzke, analysis and interpretation.

**Disclosures**

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**References**

