

Complications of Tonsillectomy

A Comparison of Techniques

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Objective: To compare the postoperative complications of intracapsular tonsillectomy using a microdebrider with traditional electrodissection tonsillectomy.

Design: Retrospective chart review.

Setting: Tertiary care pediatric referral center.

Patients: The medical records of 2944 patients undergoing tonsillectomy with or without adenoidectomy at our institution between January 1, 2002, and May 31, 2005, were reviewed.

Main Outcome Measures: Incidence of delayed postoperative hemorrhage, return to the hospital or emergency department for pain or dehydration, and the need for revision surgery.

Results: There were 1731 patients in the intracapsular tonsillectomy group and 1212 in the traditional electrodissection tonsillectomy group. The incidence of delayed

hemorrhage was 1.1% in the intracapsular tonsillectomy group and 3.4% in the traditional electrodissection tonsillectomy group ($P < .001$). For delayed hemorrhage requiring treatment in the operating room for control, the incidence was 0.5% in the intracapsular tonsillectomy group and 2.1% in the traditional electrodissection tonsillectomy group ($P < .001$). Treatment in the emergency department or hospital for pain or dehydration was necessary in 3.0% of the intracapsular tonsillectomy group and in 5.4% of the traditional electrodissection tonsillectomy group ($P = .002$). Eleven patients (0.64%) in the intracapsular tonsillectomy group required revision tonsillectomy.

Conclusion: Intracapsular tonsillectomy has a lower incidence of postoperative hemorrhage and pain leading to hospital-based evaluation compared with traditional electrodissection tonsillectomy.

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TONSILLECTOMY WITH OR without adenoidectomy is one of the most commonly performed surgical procedures in the United States. Approximately 250 000 adenotonsillectomies are performed in the United States each year.¹ The technique for performing tonsillectomy, dissection of all tonsillar tissue free of the underlying pharyngeal constrictor muscle, has not changed significantly in more than 60 years. The most common serious complication of tonsillectomy is delayed hemorrhage, which occurs in 2% to 4% of all patients.² In addition, an expected sequela of the procedure is pain, which typically lasts from 7 to 10 days and can be moderate to severe in intensity. It is generally accepted that some patients will require readmission to the hospital for control of their pain and management of dehydration owing to poor oral intake of fluids secondary to this pain.

In an attempt to mitigate these unwanted consequences, various modifications of standard tonsillectomy have been promoted over the years. These include dissection of the tonsil using monopolar or bipolar electrocautery, laser, harmonic scalpel, and bipolar radiofrequency. When first introduced, all of these techniques were touted to cause less pain or have a lower incidence of bleeding than traditional sharp dissection. In most cases, as the techniques became more widely used, these promises were not fulfilled.

For the past several years, we have been performing intracapsular tonsillectomy (IT) using a microdebrider as first described by Koltai et al³ in 2002. Since that time, we have used this technique in more than 1800 tonsillectomies with or without adenoidectomies at our institution. Our technique involves using the microdebrider to remove at least 90% of the tonsillar tissue, sparing the capsule. Suction cautery is used to fulgurate remaining ton-

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sillar tissue and for hemostasis. The vast majority of traditional tonsillectomies (TT) at our institution is performed with monopolar electrodissection of the tonsil, with suction cautery used for additional hemostasis after the tonsil is removed. We present the incidences of delayed hemorrhage and evaluation in the hospital or emergency department (ED) for postoperative pain or dehydration in a consecutive sample of patients who underwent IT, and compare these results with those of patients who underwent TT performed by the same group of surgeons during the same period.

METHODS

After institutional review board approval was obtained, the medical records of all patients who underwent tonsillectomy or adenotonsillectomy by or under the direct supervision of one of the full-time pediatric otolaryngologists (J.R., S.C., E.D., and R.O.) at the Alfred I. duPont Hospital for Children between January 1, 2002, and May 31, 2005, were reviewed. Otolaryngology residents participated in many of the surgical procedures reviewed. The type of surgery performed (TT or IT) did not influence the degree of resident participation. Data collected included patient age, sex, indication for surgery, technique used, occurrence of primary (occurring ≤ 24 hours after surgery) or secondary (occurring > 24 hours after surgery) hemorrhage, need for evaluation in the ED or hospital admission for pain or dehydration secondary to poor oral intake, need for additional operations related to adenotonsillar disease, and length of follow-up. Secondary hemorrhage was further subclassified as those requiring evaluation in the ED only, requiring readmission for observation but no surgical intervention, or requiring readmission for surgical control of the bleeding.

Data for postoperative hemorrhage and evaluation for pain or dehydration were analyzed using Fisher exact test for all 2×2 contingency tables, and χ^2 analysis was used for all larger contingency tables. $P < .05$ was considered statistically significant.

RESULTS

Between January 1, 2002, and May 31, 2005, 2944 patients underwent tonsillectomy or adenotonsillectomy for infections, hypertrophy, or both at our institution. Of these, 1533 were boys and 1411 were girls. The indications for surgery were adenotonsillar hypertrophy in 69.5%, chronic adenotonsillitis in 22.3%, and both in 8.2%. Mean length of follow-up was 20.5 months. A total of 1731 IT procedures and 1212 TT procedures were performed. One patient who had IT performed on one side and TT on the other was excluded from statistical analysis.

The sex distribution (48.0% girls) and mean age (6 years) were identical for the TT and IT groups. The mean length of follow-up for the IT and TT groups were 18 and 24 months, respectively. In the IT group, 79.0% of the patients underwent surgery for hypertrophy, 15.4% for infection, and 5.6% for both indications. In the TT group, these results were 56.0%, 32.3%, and 11.7%, respectively.

There were 3 primary hemorrhages: 2 (0.1%) in the IT group and 1 (0.1%) in the TT group ($P = .57$). There were 63 secondary hemorrhages (occurring > 24 hours

after surgery). Of these, 3 children had a known coagulopathy and were excluded from the analysis. Of the 60 remaining patients with secondary hemorrhages, 41 were in the TT group and 19 were in the IT group. The lower secondary hemorrhage rate in the IT group was statistically significant (1.1% vs 3.4%, $P < .001$), as was the lower rate of secondary hemorrhage treated in the operating room (OR) (0.5% vs 2.1%, $P < .001$).

Patients evaluated in the ED for hyperemesis believed to be secondary to the outpatient codeine preparation they were using were not considered in our calculations. Fifty-seven patients in the IT group and 67 patients in the TT group were seen in the ED or readmitted for pain with or without dehydration. The lower incidence of evaluation or readmission for pain management in the IT group was statistically significant (3.0% vs 5.4%, $P = .002$).

Because the groups were not similar in indications for surgery, subgroups were created based on the surgical indications (hypertrophy, infections, or both). We then looked at the rates of secondary hemorrhage within each group and among the subgroups. Patients with adenotonsillar hypertrophy treated with IT were statistically less likely to have a secondary hemorrhage ($P = .03$) and to require control of that hemorrhage in the OR ($P = .01$) than those treated with TT. Likewise, patients with recurrent infections treated with IT were less likely to have a secondary hemorrhage than those treated with TT. No statistically significant difference was found in the rate at which these patients required control of hemorrhage in the OR ($P = .18$). Patients with a preoperative diagnosis of both adenotonsillar hypertrophy and recurrent infections did not have a statistically significant difference in the rate of secondary hemorrhage ($P = .15$) or control of hemorrhage in the OR ($P = .28$). In the TT group, patients with a surgical indication of recurrent infections were more likely to have a secondary hemorrhage ($P \leq .05$). The indication for surgery had no effect on bleeding in the IT group. These findings are represented in **Table 1** and **Table 2**.

A similar analysis was then performed on the postoperative effect of surgical indication on evaluation for pain or dehydration (**Table 3**). Patients who underwent IT for infections were significantly less likely to be evaluated for pain or dehydration than those treated with TT ($P = .02$). The findings in the hypertrophy and both subgroups were similar and displayed a trend toward, but did not reach, statistical significance. The surgical indication had no effect on postoperative evaluation for pain or dehydration in each group.

In the TT group, 1 patient required a revision adenoidectomy during the follow-up period. In the IT group, 1 patient developed a peritonsillar abscess that required incision and drainage but not completion tonsillectomy. Eleven patients (0.6%) in the IT group required revision tonsillectomy. Ten had their primary surgery for hypertrophy and 1 for both hypertrophy and recurrent tonsillitis. Of those with a primary diagnosis of hypertrophy, 8 had hypertrophy as the preoperative diagnosis for the revision surgery and 2 had recurrent tonsillitis. The child with both hypertrophy and recurrent tonsillitis had recurrent tonsillitis after an episode of

Table 1. Effect of Surgical Indication on Secondary Hemorrhage

Technique	Indication						P Value
	Hypertrophy		Infections		Both		
	Patients, No.	SH, No. (%)	Patients, No.	SH, No. (%)	Patients, No.	SH, No. (%)	
Intracapsular	1373	15 (1.1)	263	4 (1.5)	95	0	.48
Traditional	677	16 (2.4)	393	21 (5.3)	142	4 (2.9)	.03 ^a
P value		.03 ^a		.01 ^a		.15	

Abbreviation: SH, secondary hemorrhage.

^aSignificant.**Table 2. Effect of Surgical Indication on Secondary Hemorrhages Controlled in the Operating Room**

Technique	Indication						P Value
	Hypertrophy		Infections		Both		
	Patient, No.	OR, No. (%)	Patient, No.	OR, No. (%)	Patient, No.	OR, No. (%)	
Intracapsular	1373	5 (0.4)	263	3 (1.1)	95	0	.19
Traditional	677	10 (1.5)	393	12 (3.1)	142	3 (2.1)	.21
P value		.01 ^a		.18		.28	

Abbreviation: OR, operating room.

^aSignificant.**Table 3. Effect of Surgical Indication on the Need for Postoperative Evaluation for Pain or Dehydration in the Emergency Department or Hospital**

Technique	Indication						P Value
	Hypertrophy		Infections		Both		
	Patients, No.	Pain, No. (%)	Patients, No.	Pain, No. (%)	Patients, No.	Pain, No. (%)	
Intracapsular	1373	47 (3.4)	263	4 (1.5)	95	1 (1.1)	.13
Traditional	677	35 (5.2)	393	20 (5.1)	142	10 (7.0)	.64
P value		.07		.02 ^a		.054	

^aSignificant.

mononucleosis. The mean and median length of time between primary and revision tonsillectomy was 19 months.

Patients in the IT group appeared to be less likely to require a return trip to the OR for any reason (bleeding, drainage of peritonsillar abscess, or revision tonsillectomy) than those in the TT group, but this difference did not reach statistical significance (1.2% vs 2.1%, $P = .07$).

COMMENT

The Roman physician Celsus is credited with the first written report of tonsillectomy nearly 2000 years ago. In reading his description, it becomes apparent that, even at that time, the significance of postoperative bleeding was appreciated.⁴ Since then, physicians performing tonsillectomies have looked for ways to decrease intraoperative bleeding and postoperative hemorrhage. Intraoperative blood loss and the incidence of primary hemorrhage seem

to have decreased with the use of monopolar electrocautery.⁵ This may explain why the rate of primary hemorrhage is lower than the rate of secondary hemorrhage in studies in which suction cautery is frequently used for hemostasis, even in “cold knife” tonsillectomies.^{6,7} The opposite appears to be true when suture ligation is used for hemostasis during tonsillectomy.^{8,9} This is consistent with our findings that show that the rate of primary hemorrhage was low in the IT and TT groups.

The rate of secondary hemorrhage is generally between 2% and 4%. In a recent multi-institutional retrospective review, Solares and colleagues¹⁰ noted a secondary hemorrhage rate of 3.3% in 1121 pediatric patients undergoing TT. An audit of tonsillectomies performed in England and Northern Ireland conducted in 2003-2004 found an overall delayed hemorrhage rate of 2.9%.¹¹ This is similar to our rate of 3.4%. Our incidence of 1.0% bleeding for IT compares favorably with

these figures and is similar to the rates noted in smaller series of IT.^{11,12}

Pain, by its very nature, is subjective and difficult to quantify. Prospective studies often use pain scales to quantify pain. Other measures include time until return to normal diet or activity and the amount of pain medications needed. Using these latter criteria, Nunez and colleagues¹³ found that patients treated with electrocautery tonsillectomy had a statistically significant ($P<.05$) increase in the amount of time taken to return to normal diet and in the number of analgesics consumed than those treated with cold dissection. There was no difference in the time to return to normal activity between the groups.¹³ However, the sample size was small (54 patients) in that prospective study.

Our retrospective study used return to the ED or readmission to the hospital as measures of severe pain. We believe that these are valid measures from social and economic standpoints, because these unexpected visits are associated with increased health care dollars spent, increased parental and patient stress, and, possibly, increased parental days missed from work.

Koltai et al³ looked at the incidence of readmission for dehydration after IT compared with TT and found a trend toward an increased incidence in the TT group that did not reach statistical significance.² In a larger series, Solares et al¹⁰ found a significantly decreased incidence of readmission for dehydration in an IT group compared with a TT group. These findings are consistent with our results.

This study has some flaws, most notably, it is retrospective. As with any retrospective study, patients were not randomly assigned. Without random assignment, one cannot assume that the 2 groups are equal. Although the sex distribution and mean age were identical in our groups, the mean length of follow-up was different. Although the length of follow-up may have an effect on the number of patients requiring completion tonsillectomy, it should not affect the incidence of acute complications such as secondary hemorrhage or poorly controlled postoperative pain.

Likewise, the proportion of patients in each group undergoing surgery for a given indication was not equal. It is possible that the TT group had a higher rate of bleeding and more postoperative pain because a larger percentage of patients in this group had surgery for recurrent infections. However, secondary hemorrhage was less common in patients with recurrent infection treated with IT than in those treated with TT. Although return visits to the OR for hemorrhage did not reach statistical significance, the rate was nearly 3 times higher in the TT group (3.1% vs 1.1%). This may be related to the relatively small sample size. Also, patients with recurrent infections were more commonly treated for pain or dehydration after TT than after IT.

The ideal tonsillectomy would have minimal or no risks and be completely effective. Although the risks for IT are lower than those for TT, the procedure is not always effective. Eleven patients required revision tonsillectomy

in the IT group compared with none in the TT group. However, an additional surgical procedure (including control of hemorrhage in the OR) may be more likely with TT than with IT.

We conclude that IT has a lower incidence of postoperative hemorrhage and pain leading to hospital-based evaluation than TT, although a few patients (0.6% in our study) may need revision surgery.

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Author Contributions: Dr Schmidt had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Schmidt, Cook, O'Reilly, and Reilly. *Acquisition of data:* Schmidt and O'Reilly. *Analysis and interpretation of data:* Schmidt, Herzog, and Deutsch. *Drafting of the manuscript:* Schmidt, O'Reilly, and Reilly. *Critical revision of the manuscript for important intellectual content:* Herzog, Cook, O'Reilly, and Deutsch. *Statistical analysis:* Herzog. *Administrative, technical, and material support:* Reilly. *Study supervision:* Schmidt and Reilly.

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REFERENCES

1. Shinhar S, Scotch BM, Belenky W, Madgy D, Hauptert M. Harmonic scalpel tonsillectomy versus hot electrocautery and cold dissection: an objective comparison. *Ear Nose Throat J*. 2004;83(10):712-715.
2. Krishna P, Lee D. Post-tonsillectomy bleeding: a meta-analysis. *Laryngoscope*. 2001;111(8):1358-1361.
3. Koltai PJ, Solares CA, Mascha EJ, Xu M. Intracapsular partial tonsillectomy for tonsillar hypertrophy in children. *Laryngoscope*. 2002;112(8, pt 2)(suppl 100):17-19.
4. Curtin JM. The history of tonsil and adenoid surgery. *Otolaryngol Clin North Am*. 1987;20(2):415-419.
5. Johnson LB, Elluru RG, Myer CM III. Complications of adenotonsillectomy. *Laryngoscope*. 2002;112(8, pt 2)(suppl 100):35-36.
6. Randall DA, Hoffer ME. Complications of tonsillectomy and adenoidectomy. *Otolaryngol Head Neck Surg*. 1998;118(1):61-68.
7. Pizzuto MP, Brodsky L, Duffy L, Gendler J, Nauenberg E. A comparison of microbipolar cautery dissection to hot knife and cold knife cautery tonsillectomy. *Int J Pediatr Otorhinolaryngol*. 2000;52(3):239-246.
8. Windfuhr JP, Chen YS. Hemorrhage following pediatric tonsillectomy before puberty. *Int J Pediatr Otorhinolaryngol*. 2001;58(3):197-204.
9. Silveira H, Soares JS, Lima HA. Tonsillectomy: cold dissection versus bipolar electrodissection. *Int J Pediatr Otorhinolaryngol*. 2003;67(4):345-351.
10. Solares CA, Koempel JA, Hirose K, et al. Safety and efficacy of powered intracapsular tonsillectomy in children: a multi-center retrospective case series. *Int J Pediatr Otorhinolaryngol*. 2005;69(1):21-26.
11. Lowe D, van der Meulen J. National Prospective Tonsillectomy Audit. Tonsillectomy technique as a risk factor for postoperative haemorrhage. *Lancet*. 2004;364(9435):697-702.
12. Sorin A, Bent JP, April MM, Ward RF. Complications of microdebrider-assisted powered intracapsular tonsillectomy and adenoidectomy. *Laryngoscope*. 2004;114(2):297-300.
13. Nunez DA, Provan J, Crawford M. Postoperative tonsillectomy pain in pediatric patients: electrocautery (hot) vs cold dissection and snare tonsillectomy—a randomized trial. *Arch Otolaryngol Head Neck Surg*. 2000;126(7):837-841.