Factors associated with post-tonsillectomy hemorrhage

Patrick J. Collison, MD, FACS
Bret Mettler, MD

Abstract
Despite the otolaryngologist’s most diligent efforts to prevent it, hemorrhage is the most common, albeit sporadic, significant complication of tonsillectomy. For this retrospective study of post-tonsillectomy hemorrhage rates, we examined the charts of 430 consecutive tonsillectomy patients who had been operated on by one of two general otolaryngologists at our institution. The two surgeons used the same removal technique (cold dissection and snare), but slightly different methods of hemostasis.

We found that the overall bleeding rate was 4%; the primary (<24 hr) hemorrhage rate was 0.23%, and the secondary rate was 3.7%. Factors that were positively correlated with postoperative bleeding were the patient’s sex, the time of year the surgery was performed, the length of the procedure, the amount of blood lost during surgery, and the use of intraoperative vasoconstrictors and steroids. However, we believe the use of steroids can probably be discounted as a causative factor.

The χ² test was used to determine statistical significance. None of the 21 patients who were operated on for peritonsillar abscess experienced any delayed postoperative bleeding. The mean decrease in hemoglobin was 2.3 grams; the lowest postoperative level was 6.6 grams. The highest incidence of delayed bleeding occurred on the eighth postoperative day. Two patients required transfusions, and both recovered without any adverse consequences.

It appears that one controllable variable in preventing delayed bleeding following tonsillectomy and adenoidectomy might be related to certain details of hemostatic technique. Vasoconstrictors and “field” cautery might be associated with an increased temporal and spatial application of coagulating current. Although this technique is very effective in preventing primary hemorrhage, it does result in a deeper and more extensive zone of necrosis and the exposure of more and larger vessels when sloughing of the eschar occurs.

Introduction
Tonsillectomy and adenoidectomy (T&A) is an effective and safe surgical procedure when the appropriate indications are present. Although the number of these operations has declined from approximately 2 million in 1965 to 1 million in 1970 to 750,000 in 1987, it is still a relatively common procedure. Postoperative hemorrhage is the most common complication, and when it occurs, the experience is frightening and uncomfortable for the patient and worrisome for the surgeon. In rare instances, post-T&A bleeding can even be life threatening.

Prior to 1985, the incidence of post-T&A bleeding was reported to range from less than 1% to as high as 20%, but more recent reports put the rate closer to 3%. Bleeding is usually classified as primary (onset: <24 hr postoperatively) and secondary (≥24 hr, usually 5-10 days). The cause of primary bleeding is generally acknowledged to be inadequate hemostasis during the procedure. Although the cause of secondary (delayed) bleeding is less certain, the sloughing of the superficial eschar from the tonsillar fossa is believed to be the inciting event. Early studies reported an equal incidence of primary and delayed bleeding, but most recent articles cite a lower rate of primary hemorrhage; they also describe the rate of secondary hemorrhage as low and stable.

The literature on post-T&A bleeding—specifically regarding its incidence, timing, and predisposing factors—is often contradictory. Some of the differences can be attributed to incomplete data in the older studies and to different definitions of what constitutes significant bleeding. Factors that are usually not correlated with a higher incidence of bleeding are the type of anesthetic, the use of antibiotics and steroids, the indication for surgery, the method of excision, the surgeon’s experience, and postoperative dietary and activity restrictions. In a 1988 review of 6,842 patients, Chowdhury et al claimed that “secondary post T&A hemorrhage...is unrelated to surgical technique.” Other reports, however, seem to show a higher rate of delayed bleeding when cautery is used for hemostasis. Also, when ligature is compared with cautery, a higher rate of primary bleeding is attributed to the former, and a higher rate of delayed bleeding is ascribed to the latter. According to some reviews, the
bleeding rate seems to be somewhat higher among older patients and males, and it appears to be higher during the spring and summer.  

Despite the surgeon's diligent efforts to achieve complete hemostasis, post-T&A hemorrhage is an occasional concern for both patient and otolaryngologist. The loss of blood notwithstanding, minimizing the incidence of this complication is important because postoperative hemorrhage can lead to airway compromise and the need for additional intervention and anesthesia, and it increases costs and overall inconvenience for physician and patient alike. The question then is, Can delayed post-T&A bleeding—which seems to occur in a sporadic, unpredictable manner—be prevented? In this article, we examine the incidence, severity, and factors associated with post-T&A hemorrhage in a community hospital.

Materials and methods
We reviewed the medical records of all patients who had undergone tonsillectomy, with or without adenoidectomy, between May 1, 1995, and Dec. 31, 1998. We gathered the following data from each record: (1) the date of the procedure, (2) the age and sex of the patient, (3) the indication for surgery, (4) the presence of any concurrent diseases, (5) the personal and family history of bleeding, (6) medication use, (7) the results of preoperative clotting studies, (8) the surgical technique (including the method of removal and hemostasis, the use of preoperative steroids and antibiotics, and the length of the procedure) and the estimated intraoperative blood loss, (9) the length of stay, (10) the nature of the postoperative instructions, (11) the tonsil size, and (12) the incidence, amount, timing, and treatment of postoperative bleeding.

All patients had been admitted on the morning of the procedure and discharged at the discretion of the surgeon, with input from parents and nurses. All patients had been scheduled to return for a routine followup appointment 1 week following surgery, and all had been placed on similar dietary and activity restrictions and given instructions to call if persistent bleeding occurred. Postoperative hemorrhage was defined as any bleeding event that required any type of medical intervention.

Surgical technique. All of the procedures had been performed by one of two general otolaryngologists—213 by "surgeon A" and 217 by "surgeon B." Both used the same dissection and snare technique for tonsil removal. All procedures had been performed with the use of general anesthesia. Surgeon A administered 8 mg of IV dexamethasone prior to the procedure, injected 5 ml of 1% lidocaine with 1:100,000 epinephrine into the peritonsillar space before making the incision, and packed the fossae with oxymetazoline-soaked tonsil sponges after removal. Surgeon B used no IV dexamethasone and no injected or topical vasoconstrictors. Both surgeons used Valley Lab (Model No. E 2505-10FR) suction electrocautery for hemostasis, with the coagulating cautery set at 30 to 35. The administration of perioperative antibiotics and postoperative analgesics was similar for all patients.

Statistical analysis. Medical records data were entered into a computer spreadsheet program for statistical analysis. The χ² test was used to identify statistically significant differences.

Results
During the 3.5-year study period, 430 patients had undergone tonsillectomy, with or without adenoidectomy, at Avera Sacred Heart Hospital in Yankton, S. Dak. A total of 213 procedures had been performed by surgeon A and 217 by surgeon B. These cases were seen consecutively. No other surgeon had performed T&A at this institution during this span.

Following surgery, 17 patients (4%) experienced postoperative hemorrhage. One patient (0.23%) developed primary hemorrhage, and 16 (3.7%) developed secondary hemorrhage. The onset of bleeding occurred anywhere from less than 24 hours to 15 days following surgery (mean: 8 days) (figure 1). Of the 17 patients who experienced postoperative hemorrhage, 14 required a return to the operating room (and general anesthesia) to control the bleeding. Of the remaining three patients, one underwent cautery in the emergency room, and two were admitted for observation only. The mean decrease in hemoglobin after the bleeding episodes was 2.3 grams; the lowest level was 6.6 grams. Two patients received blood transfusions. There were no deaths.

Figure 1. The highest incidence of delayed bleeding occurred on the eighth postoperative day.

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Variables associated with bleeding. When bleeders were compared with nonbleeders, several differences were noted with respect to sex, the time of year, and several particular aspects of surgical technique (table):

- The male-to-female ratio was 0.41-to-1 among the group as a whole, but 0.65-to-1 among the bleeders (p<0.05).
- A significantly larger proportion of bleeds occurred among patients who had undergone their surgery during the late spring or summer (figure 2) (p<0.05).
- An association was seen between postoperative bleeding and the length of the procedure (35 min for bleeders vs. 27 min for nonbleeders; p = 0.0673), the estimated blood loss (41 ml for bleeders vs. 49 ml for nonbleeders; p = 0.11389), and the use of injected and topical vasoconstrictors and steroids (6.1% bleeding rate with these agents vs. 1.8% without them; p<0.05).

Variables not associated with bleeding. As expected, most of the variables we considered were not correlated with postoperative bleeding. They included the patient’s age, indications for surgery, concurrent illnesses, personal and family bleeding history, medication use, preoperative coagulation profile, the length of stay, and tonsil size (table):

- The mean age of all patients was 11.1 years (range: 2-54); the mean age of the 17 patients who experienced postoperative bleeding was 12.0 years.
- The surgical indications for the nonbleeders included recurrent adenotonsillitis (40%), adenotonsillar hypertrophy (28%), recurrent adenotonsillitis and adenotonsillar hypertrophy (28%), and peritonsillar abscess (5%). There was no significant difference between the bleeders and nonbleeders with respect to surgical indication (figure 3). Where documented, the mean number of episodes of recurrent adenotonsillitis per year was 5.5 (range: 3-12), and strep cultures were positive in 21% of patients. None of the patients with peritonsillar abscess experienced postoperative bleeding.
- Most patients had no other medical problems. Among those who did, their concurrent diseases included asthma (10 patients), seizure disorder (3), cerebral palsy (3), Down’s syndrome (2), cerebellar ataxia (1), panhypopituitarism (1), and autism (1). These conditions were not associated with bleeding risk.

- No patient had a personal or family history of bleeding disorder.
- Prior to surgery, four patients had been taking a nonsteroidal anti-inflammatory drug, and 15 had been taking a cephalosporin. None of these patients bled.
- The results of clotting studies showed that all 430 patients had platelets within normal limits, 15 had an elevated partial thromboplastin time (PTT), and two had an elevated prothrombin time. Because only one of the patients with an elevated PTT developed delayed bleeding, it was evident that an abnormal PTT value does not reliably predict this risk.

### Table. Relationship between studied variables and the incidence of postoperative bleeding

<table>
<thead>
<tr>
<th>Factors associated with bleeding</th>
<th>Factors not associated with bleeding</th>
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</thead>
<tbody>
<tr>
<td>Sex (p&lt;0.05)</td>
<td>Age</td>
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<tr>
<td>Time of year (p&lt;0.05)</td>
<td>Indication for surgery</td>
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<tr>
<td>Use of vasoconstrictors and steroids (p&lt;0.05)</td>
<td>Concurrent illnesses</td>
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<td>Length of procedure (p = 0.0673)*</td>
<td>Personal/family bleeding history</td>
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<tr>
<td>Estimated blood loss (p = 11389)*</td>
<td>Medication use</td>
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<td></td>
<td>Preoperative coagulation profile</td>
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<td>Length of stay</td>
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<td>Tonsil size</td>
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* Not statistically significant.

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**Figure 2.** A significantly larger proportion of bleeds occurred among patients who had undergone their surgery during the late spring or summer (p<0.05).
- Ten percent of the patients were discharged on the evening of the day they underwent the procedure, and the rest on the following morning. The length of stay was not related to bleeding risk.
- The mean tonsil size for both bleeders and nonbleeders was 2.9 cm (range: 1.4 to 4.5).

**Discussion**

The statistically significant variables associated with an increased risk of delayed hemorrhage in this study were the patient’s sex, the time of year the surgery was performed, and the use of intraoperative vasoconstrictors and steroids. The length of the procedure and the estimated blood loss were inversely correlated with delayed bleeding, but the differences did not reach statistical significance.

Several earlier prospective double-blind studies found no association between steroid use and bleeding rates,\(^{15,21,22}\) and so even though we found a statistically significant difference, we believe that this variable can probably be discounted as a causative factor. Others have noted higher bleeding rates among young males and during the more temperate months of the year, as did we.\(^{10,13,20,25}\) Although no definite conclusions can be drawn from these observations, it can be reasonably inferred that an early return to vigorous activity makes delayed bleeding more likely. The avoidance of strenuous activity for a full 2 weeks is probably prudent, although difficult to enforce.

An interaction between the effect of local vasoconstrictors and the application of electrocautery to peritonsillar tissue can be offered to explain the results of this study. Intense vasoconstriction with 1% lidocaine plus epinephrine is useful in limiting intraoperative bleeding, achieving a dry operative field, and making dissection easier. However, because it hinders visualization of actively bleeding vessels, it encourages surgeons to use random or “field” cauterization rather than a point application with coagulating current. Also, the marked diminution of blood flow through submucosal tissue can prevent the dissipation of applied thermal energy. Both of these factors result in a deeper, more extensive zone of necrosis and the exposure of more and larger vessels when the eschar later sloughs.

Kennedy and Strom supported this conclusion in their study entitled, “A comparison of postoperative bleeding incidence between general and local anesthesia tonsillectomies.”\(^{24}\) A close look at their data reveals that 15 of 120 patients (12.5%) who received lidocaine with epinephrine developed postoperative bleeding, while only 1 of 72 patients (1.4%) who were not injected with epinephrine bled. This statistically significant difference is comparable to the threefold increase in bleeding seen in our study. In replying to Kennedy and Strom’s article, Blatt reported that the bleeding rate after local tonsillectomy was only 1% when lidocaine 1% is used without epinephrine.\(^{23}\) He wrote that “the exclusion of epinephrine assures the surgeon of a more accurate hemostasis in the operating room.”

Some authors have noted a lower rate of delayed bleeding when tonsillectomy is performed for acute peritonsillar abscess (tonsillectomy a chaud), but a higher risk of bleeding when surgery is performed electively after a peritonsillar abscess has resolved (tonsillectomy a froid).\(^{23}\) This is probably brought about by a fibrosis of the peritonsillar space and the loss of a discrete tissue plane around the tonsil capsule, which can result in a more difficult dissection and the exposure of deeper vessels. The fact that none of the 21 peritonsillar abscess patients in our study developed delayed hemorrhage tends to support these observations. Therefore, concerns about an increased
risk of bleeding cannot be used as an excuse to withhold “abscess tonsillectomy” in patients who prefer this more definitive method of treatment.\textsuperscript{38}

In our study, the 17 patients who bled experienced no apparent long-term sequelae. However, the amount of blood loss (mean Hgb decrease: 2.3 grams; lowest level: 6.6 grams) serves as a reminder that post-T&A hemorrhage is not a trivial matter. Isolated case reports of catastrophic bleeding can be found, and no single technique can be recommended as an absolute guarantee against these rare but worrisome events.\textsuperscript{2,4} Gardner does caution specifically against the use of deeply placed sutures to control bleeding.\textsuperscript{4} The adventitia or even the lumen of named vessels—specifically the tonsillar branches of the facial artery—can be engaged by the needle and cause profuse delayed bleeding. Tonsillectomies by laser and by electrocautery dissection have been touted for their lessening of intraoperative blood loss and operative time, but they offer no advantage in terms of postoperative bleeding and discomfort.\textsuperscript{27}

Although an ideal method of tonsillectomy has never been devised—and probably never will be—suction electrocautery is certainly an efficient and relatively safe method of achieving hemostasis. Several authors have stressed the importance of point coagulation directed only at the visible, actively bleeding vessel.\textsuperscript{11,12} The findings of our study support the use of directed suction electrocautery without vasoconstrictors for hemostasis in tonsillectomy.

References


