Study of Patients' Return to Surgery Post-Tonsillectomy and/or Adenoidectomy

A Relation Between Patient Age and Timing of Uncontrolled Bleeding

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Abstract

Background: Tonsillectomy and/or adenoidectomy (T/A) are common surgical procedures. Postoperative uncontrolled bleeding is a well-established complication; however, the relation between certain variables and uncontrolled bleeding are unclear.

Methods: We explored the Pennsylvania Patient Safety Reporting System database for event reports that described a patient who had a T/A procedure and later returned to surgery to control bleeding. We analyzed the post-T/A bleeding events according to numerous variables, such as patient sex and age, timing of the bleed, procedure performed (i.e., tonsillectomy and/or adenoidectomy), and bleeding site.

Results: We identified 219 event reports from 56 healthcare facilities over a four-year period. The study revealed that 78% of the patients were discharged and then returned to surgery to control bleeding. Patients ranged in age from 1–45 years and 53% were female. Among the 219 events, 41% were a primary bleed (0–1 postoperative days) and 59% were a secondary bleed (2–30 postoperative day). Additionally, 0–1 days and 6–7 days after operation were the periods when patients most frequently returned to surgery (range of 0–30 days). We expanded upon much of the previous research by exploring the relation between patient age and days postoperative return to surgery. We found that a majority of patients in age categories 1–10, 11–20, and 21–30 years had a *secondary bleed*; in contrast, a majority of patients age 31–45 had a *primary bleed*.

Conclusion: Our findings indicate that the post-T/A timing of uncontrolled bleeding may vary systematically as a function of patient age; however, future research is needed to better understand this topic. We encourage readers to use our findings, along with findings from previous research, to inform their practice and strategies to mitigate risk of patient harm.

Keywords: *return to surgery, hemorrhage, primary bleed, secondary bleed, tonsil, adenoid, patient safety, patient harm, adverse event, risk, otolaryngology, ENT, perioperative, postoperative complication*

◆Patient Safety Authority
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Introduction

Tonsillectomy and/or adenoidectomy (T/A) are common surgical procedures and more than 471,000 are performed annually.[1,2] Despite the prevalence of these procedures, there is a well-established risk of complication, such as postoperative uncontrolled bleeding.[2,3] For example, according to previous studies of tonsil bleeding, the rate varies considerably from <1%–20% of patients.[4-22] Although there are noninvasive remedies to control mild T/A-related bleeding (e.g., direct pressure, silver nitrate), patients with significant bleeding typically must return to surgery.[23] In some instances the risk of harm associated with uncontrolled bleeding can be relatively low because the patient has yet to be discharged and can be quickly returned to surgery. In other instances, the risk for harm can be much higher, particularly when bleeding occurs after discharge[23] and surgical intervention is delayed (e.g., impacted by patient's travel time to return to a healthcare facility).[24,25]

The purpose of the present study was to explore the Pennsylvania Patient Safety Reporting System (PA-PSRS)[a] database for event reports that described a patient who had a T/A procedure and later returned to surgery to control bleeding. Our goal was to better understand the instances of post-T/A bleeding by analyzing the events according to numerous variables, such as patient sex and age, timing of the bleed, procedure performed (i.e., tonsillectomy and/or adenoidectomy), and bleeding site.

Methods

Data Source and Sample

Data in this study were collected from event reports created by individuals working in hospitals or ambulatory surgical facilities and submitted to the PA-PSRS database. Each event report consisted of responses to many structured fields (e.g., event date, patient age, patient sex, care area) and several free-text narrative fields, which are used to describe the event and actions taken. Given the unstructured nature of free-text narrative fields, the quantity and quality of the information varies from one report to another. Responses within the free-text fields of some reports are often concise and none of the reports include access to patients' medical records, billing codes, or other sources of information; nevertheless, in many reports the information is sufficient for analysis.

We conducted a two-phase process to select and identify relevant events for inclusion in the study. The first phase consisted of a database query, where we applied the following inclusion criteria:

- Event date: January 1, 2016, to December 31, 2019
- One or more of the following phrases were included in the free-text narrative fields: "tonsil," "adenoid," "T&A," T & A," or "T and A."
- Event classification: Serious Event[b]

Our query produced an output of 341 events, which were subsequently reviewed by one researcher, and the following criteria were applied to identify reports consistent with the study scope:

- Patient had a tonsillectomy and/or adenoidectomy (T/A).
- Following completion of the procedure, the patient returned to surgery to control bleeding at the tonsil or adenoid site.

Based on the criteria, we identified 219 event reports for inclusion in our study.

[a]PA-PSRS is a secure, web-based system through which Pennsylvania hospitals, ambulatory surgical facilities, abortion facilities, and birthing centers submit reports of patient safety–related incidents and serious events in accordance with mandatory reporting laws outlined in the Medical Care Availability and Reduction of Error (MCARE) Act (Act 13 of 2002).[26] All reports submitted through PA-PSRS are confidential and no information about individual facilities or providers is made public.

[b]*Serious Event* is defined as an event, occurrence, or situation involving the clinical care of a patient in a medical facility that results in death or compromises patient safety and results in an unanticipated injury requiring the delivery of additional healthcare services to the patient.[26]

Variables Coded

We explored two sets of variables. The first set was coded by the event reporter (i.e., facility-assigned personnel who submitted the event report to PA-PSRS) and consisted of demographic and clinical variables (e.g., patient age and sex, event date). The second set of variables was coded by one researcher based on manual review of the event reports. The variables coded included the following: procedure performed (i.e., tonsillectomy and/or adenoidectomy); site of uncontrolled bleeding; whether the patient was discharged prior to returning to surgery; days after operation that the patient returned to surgery; type of bleeding[c] (primary bleed, 0–1 postoperative days versus secondary bleed, 2–30 postoperative days);[23,27] month or season of secondary bleed; receiving a blood transfusion; diagnosis of developmental disability; diagnosis of blood disorder; and death. During manual review of the 219 event reports, we identified 19 reports with insufficient information. We contacted the healthcare facilities about those 19 reports and acquired additional information to create a more complete data set.

Readers should note that instances of postoperative bleeding that involved patients who were identified as high-risk would not have been reportable to the PA-PSRS database if the increased risk of uncontrolled bleeding was communicated to the patient/family prior to the procedure. As a result, we hypothesized that our sample of events likely would not be representive of patients who were deemed high-risk. We chose to code the event reports for a small set of conditions (e.g., diagnosed bleeding disorder, developmental disability) that could be reflective of higher risk with the purpose of helping the reader better understand the patient sample and verifying that high-risk patients were a small portion of the sample.

Data Analysis

Descriptive Analysis. All variables were measured by frequency of occurrence and were subjected to a descriptive analysis. A descriptive analysis is an approach where phenomena are identified and patterns are explored to better understand and explain the conditions in which the phenomena occur.[28,29] This type of analysis is not used to identify causal relations; rather, it is used to characterize the context of the phenomena, point toward possible causal mechanisms, and generate hypotheses. With a descriptive analysis, data are presented in a manner favoring simplicity with minimal statistical adjustments, as opposed to complex statistical modeling or an unnecessarily complex presentation of the data, to help a broader audience readily comprehend the findings. This type of analysis is often achieved with graphs and tables of the data that will allow a triangulation among various combinations of variables. Overall, our goal with this approach is to analyze and present the data in a manner that is most useful for readers.

Statistical Analyses. We used a two-tailed Fisher's exact test (α=0.05) to analyze the relation between groups of patient age and type of bleeding (primary versus secondary). We also applied a Spearman's rank correlation (α=0.05) to analyze the relation between patient age and the number of postoperative days when the patient returned to surgery to control bleeding. A positive correlation coefficient indicates that values of patient age and postoperative days would increase concurrently and a negative correlation coefficient would indicate that as patient age increases the days postoperative return to surgery would decrease.

Results

We identified 219 event reports from 56 healthcare facilities over a four-year period. Across all 219 event reports, 97% (213 of 219) described the patient having only one return to surgery to control bleeding post-T/A procedure; therefore, all results are based on the first occurrence of a return to surgery, unless noted otherwise.

Events by T/A Procedure Performed and Bleeding Site

Table 1 shows the frequency of events by type of T/A procedure performed and bleeding site. The results reveal that a tonsillectomy was described in 99.5% (218 of 219) of the event reports and an adenoidectomy was described in 51% (112 of 219) of the reports. Among the reports that described an adenoidectomy, 15% (17 of 112) involved an adult (range=18–43 years, average=26, median=25). The table also shows that among the event reports that identified the bleeding site, 99% (186 of 187) involved a tonsil and 1% (2 of 187) involved an adenoid. The two events that described an adenoid bleed both involved children (ages 3 and 9 years).

Events by Patient Sex and Age

Figure 1 shows the distribution of events by patient sex and age. Across all 219 event reports, 53% (116 of 219) of patients were reported as female and their average age was 15 years (minimum=1 year, 25th percentile=7, median=13, 75th percentile=19, maximum=39). Male patients were reported as 47% (103 of 219) of the sample and their average age was 16 years (minimum=2 years, 25th percentile=6, median=13, 75th percentile=23.5, maximum=45).

Events by Patient Age and Type of Bleeding; Primary Versus Secondary

Across all 219 event reports, 41% (89 of 219) described a primary bleed (0–1 postoperative days) and 59% (130 of 219) described a secondary bleed (2–30 postoperative days). **Figure 2** reveals the relation between patient age and primary versus secondary bleeding. Secondary bleeding occurred in 42% (10 of 24) of the patients age 31–45 years, but in 59% or more of the patients in age categories of 1–10, 11–20, and 21–30 years.

We hypothesized that there was a significant relation between patient age (1–30 years, 31–45 years) and the type of bleeding (primary, secondary). We tested this hypothesis using a two-tailed Fisher's exact test and found a nonsignificant relation between patient age and type of bleeding, p=0.078. We conducted a post hoc power analysis for Fisher's exact test using the "power.fisher.test" function within the statmod R library.[30] This function estimates the power through a simulation of the

[c]Primary bleeding is typically associated with operative technique and secondary bleeding is often associated with sloughing of the primary eschar at the surgical site.[27] Primary bleed is typically defined as a postoperative bleed that occurs within the first 24 hours and a secondary bleed is a postoperative bleed that occurs beyond the first 24 hours, but within the first 30 days of the procedure. Few event reports provided the hour of return to surgery and instead only provided the date of return; therefore, we defined the primary bleed period as any patient's return to surgery during days 0–1 (same day or day following procedure).

Among the 219 PA-PSRS event reports from 2016-2019 that described a patient returning to surgery for uncontrolled bleeding post-T/A:

- 56 unique healthcare facilities submitted at least one report
- 99% of reports (186 of 187) that identified a bleeding site described bleeding that involved a tonsil and 1% (2 of 187) involved an adenoid (note: 32 of the event reports did not identify the bleeding site)
- 15.5 years was the average age of the patients (range 1–45 years)
- 78% of reports (171 of 219) described the patient being discharged and then returning to surgery to control bleeding
- 41% of reports (89 of 219) described a primary bleed (days 0–1) and 59% (130 of 219) described a secondary bleed (days 2-30)
- 0–1 days and 6–7 days postoperative were the periods when patients most frequently returned to surgery (average of 4.5 days, range of 0-30 days)
- A majority of patients in age categories 1–10, 11–20, and 21-30 years had a secondary bleed; in contrast, a majority of patients aged 31-45 had a primary bleed
- During the secondary bleed period (days 2–30), patients aged 31–45 years had the greatest rate of return during days 4–5; however, the other age categories had the greatest return rate during days 6–7
- 3% of reports (6 of 219) described the patient returning to surgery twice to control bleeding
- No systematic pattern of postoperative secondary bleeding by month or season was identified
- 3% of reports (6 of 219) described the patient having a developmental disability
- 1% of reports (3 of 219) described the patient receiving a blood transfusion
- 0% of reports (0 of 219) described the patient having a bleeding disorder
- 0% of reports (0 of 219) described a patient death related to uncontrolled bleeding

various contingency tables, and it showed that our Fisher's exact test with a sample of 219 events had a power of 0.44; to achieve an optimal level of power (close to 0.80), the sample size would need to be increased to 299 events. Based on this finding, it is plausible that there is an underlying significant relation between patients age 31–45 years and a greater likelihood of a primary bleed, when compared to younger patients; however, we were unable to statistically detect this relation due to insufficient power.

Events by Patient Age and Postoperative Days

Table 2 shows a summary of the relation between patient age and the number of postoperative days when the patient returned to surgery to control bleeding. Across all 219 reports, the average days after operation was 4.5, with a minimum of 0 days (same day return) and a maximum of 30 days.

The bars in **Figure 3** show the periods when the patients, across all ages, most frequently returned to surgery, which were during postoperative days 0–1 (41%, 89 of 219 reports) and days 6–7 (19%, 42 of 219 reports). The bars also reveal a notable decrease in return to surgery beyond day 13, with only 4% of the events (8 of 219) occurring between postoperative days 14 and 30.

The lines in **Figure 3** reveal differences in rates of return to surgery by category of age and postoperative days. Patients age 31–45 years, when compared to the other three age categories, had the greatest percentage of events (58%, 14 of 24) during postoperative days 0–1, but during days 6–7 the same patients had the lowest percentage (4%, 1 of 24 events). Also, during the secondary bleed period (days 2–30), patients age 31-45 years had the greatest rate of return during days 4–5; however, the other age categories had the greatest return rate during days 6–7. Finally, the lines in **Figure 3** also reveal that during the secondary bleed period (days 2–30), patients age 31–45 years had less variability in percentage from one day to the next (i.e., flatter line), which contrasts sharply with a relatively higher variability in the younger age categories.

Figure 4 shows the frequency of events by patient age and postoperative days. Based on visual inspection of the figure, a majority of events associated with patients age 1–30 years occurred during postoperative day 0 and days 6–9. With older patients, age 31–45 years, the events were primarily concentrated during postoperative day 0–1. Across all patient ages, the figure reveals a relatively low frequency of events during postoperative days 2–5.

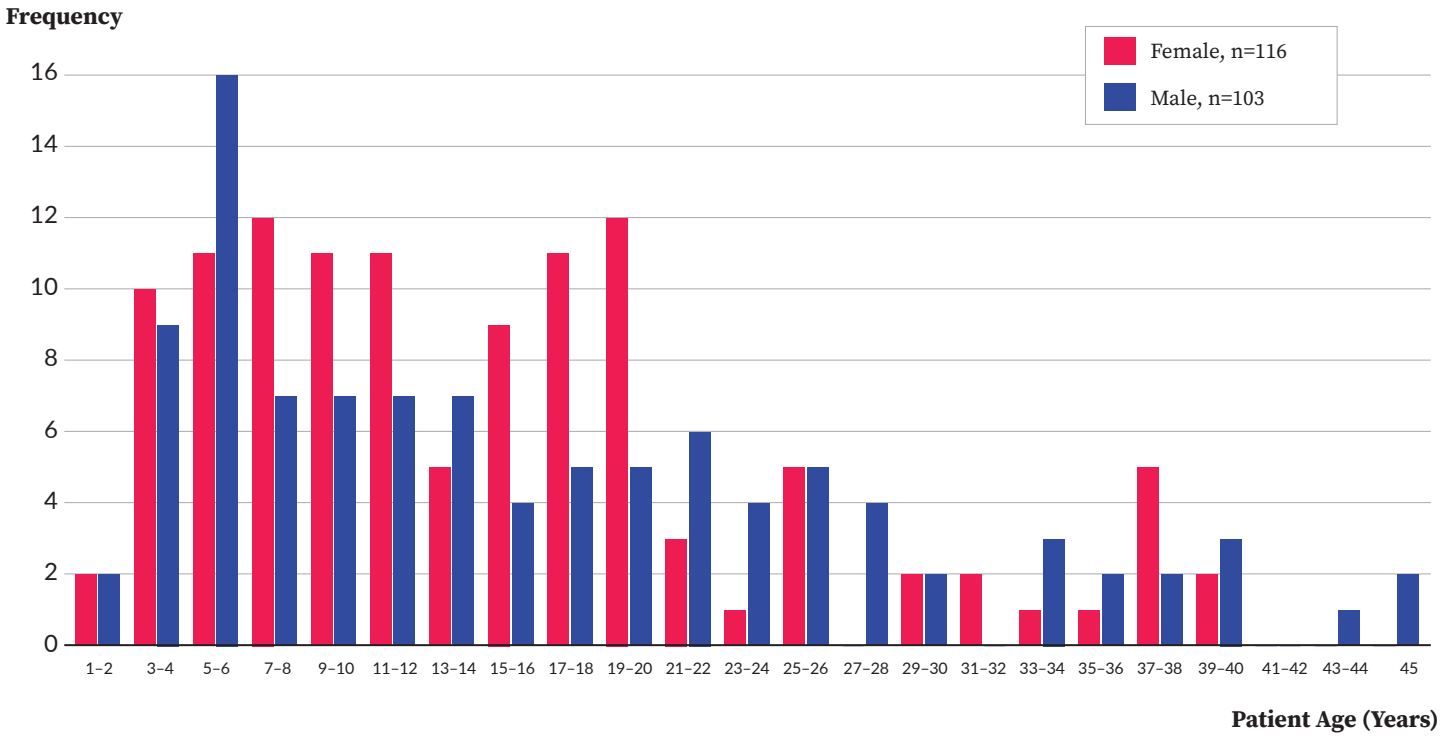
The linear trend line in **Figure 4** indicates a negative relation between patient age and postoperative days, which would suggest that patients with a greater age are more likely to return to surgery in a shorter period after operation than patients with a lower age. We tested this hypothesis (α=0.05) and found a small and nonsignificant negative correlation between patient age and postoperative days (r_s= -0.09, n=219, 2-tailed p=0.21).

Table 1. Frequency of Post-T/A Return to Surgery for Uncontrolled Bleeding by Procedure(s) Performed and Bleeding Site(s), N=219 PA-PSRS Event Reports

	T/A Procedure(s) Performed			
Bleeding Site(s)	T&A	Tonsillectomy Only	Adenoidectomy Only	**Total**
Tonsil(s) Only	78	107	-	**185**
Adenoid(s) Only	-	-	1	**1**
Tonsil(s) and Adenoid(s)	1	-	-	**1**
Unspecified	32	-	-	**32**
Total	**111**	**107**	**1**	**219**

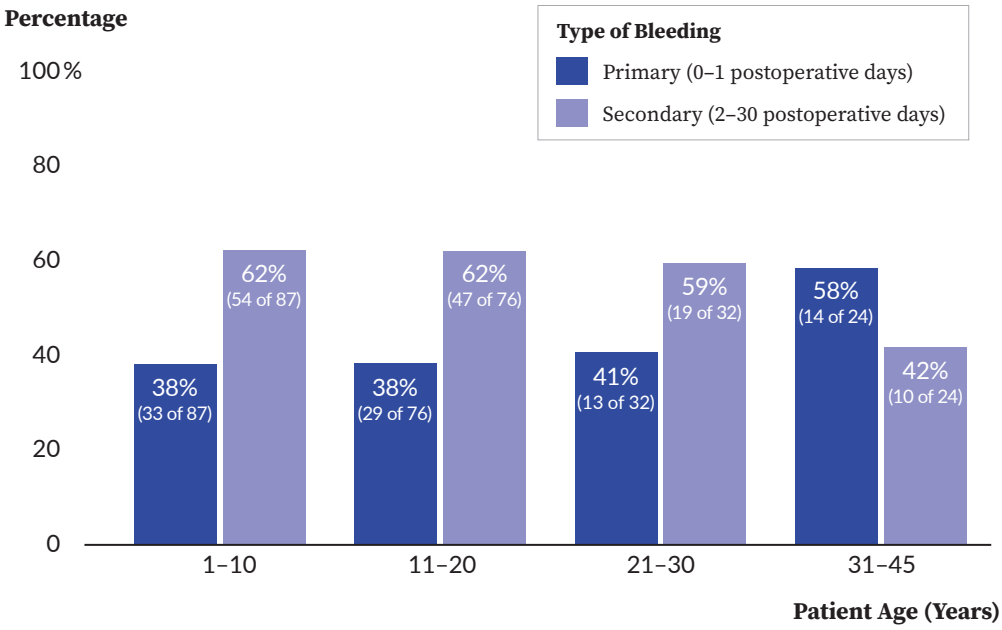
Note: The categories of procedures and bleeding sites were mutually exclusive. Cells with a - represent a zero frequency per combination of categories.

Figure 1. Post-T/A Return to Surgery for Uncontrolled Bleeding by Patient Sex and Age, N=219 PA-PSRS Event Reports



Note: Across all 219 event reports, patient age was an average of 15.5 years, minimum of 1, 25th percentile of 7, median of 13, 75th percentile of 21, and maximum of 45.

Figure 2. Post-T/A Return to Surgery by Type of Uncontrolled Bleeding, N=219 PA-PSRS Event Reports



Note: Primary bleeding is typically associated with operative technique and secondary bleeding is often associated with sloughing of the primary eschar at the surgical site.[27] We hypothesized that there was a significant relation between patient age (1–30 years, 31–45 years) and the type of bleeding (primary, secondary). We tested this hypothesis using a two-tailed Fisher's exact test and found a nonsignificant relation between patient age and type of bleeding, p=0.078.

Patients Who Returned to Surgery Twice for Uncontrolled Bleeding

Across the 219 event reports, 3% (n=6) described a patient returning to surgery twice to control tonsillar bleeding. Among these patients, all were male and they were ages 6, 8, 26, 27, 28, and 33 years. Among the six patients, two had both their first and second returns to surgery on the same dates, but the other four patients had their first and second returns to surgery on different dates (e.g., first return to surgery was on postoperative day 2 and the second return was on day 8). None of the six patients had their first or second return to surgery on the same date as the original procedure.

Relation Between Return to Surgery for Uncontrolled Bleeding and Other Variables

Across all 219 event reports during the four-year period of 2016–2019, we found that an average of 55 events occurred per year and an average of 5 events per month (median=4, range of 0 to 10 per month). We explored the events further to determine if the frequency of secondary bleed (2–30 postoperative days) varied by month or season; however, we found no pattern by month or season across the four-year period. We found that 1% (3 of 219) of event reports described a patient receiving a blood transfusion and 0% (0 of 219) of the reports described a patient death associated with uncontrolled bleeding. Finally, we found that 3% (6 of 219) of the event reports described a patient as having a developmental disability and 0% (0 of 219) reported a patient having a bleeding disorder.

Discussion

Our results are both consistent and contrasting with previous research, which are summarized in **Table 3**. Our study expanded upon much of the previous research on post-T/A bleeding by exploring the relation between patient age and days after operation when the patient returned to surgery. **Figure 2** shows that patients beyond 30 years of age had roughly 20% less secondary bleeding, when compared with younger patients. **Figure 3** reveals that during the secondary bleed period (days 2–30), patients beyond 30 years of age had less variability in their rate of return to surgery from one day to the next throughout the 2–10 day postoperative period, when compared with younger patients. We found that the highest percentage of patients age 1–30 returned to surgery during days 0–1 and days 6–7, and patients age 31–45 had the highest percentage of return during days 0–1 and days 4–5. Finally, a majority of returns to surgery for patients age 1–30 years occurred during 0–14 postoperative days and a majority of patients age 31–45 years returned during days 0–10.

Based on these results, it may be advisable for providers and staff to monitor patients age 31–45 years for a longer period prior to discharge, communicate periods of greatest risk to patients, and consider patient age as an important factor in the timing of postoperative phone calls.[d] Despite the implications of our findings, further research is required to explore the replicability of the relation between patient age and postoperative days.

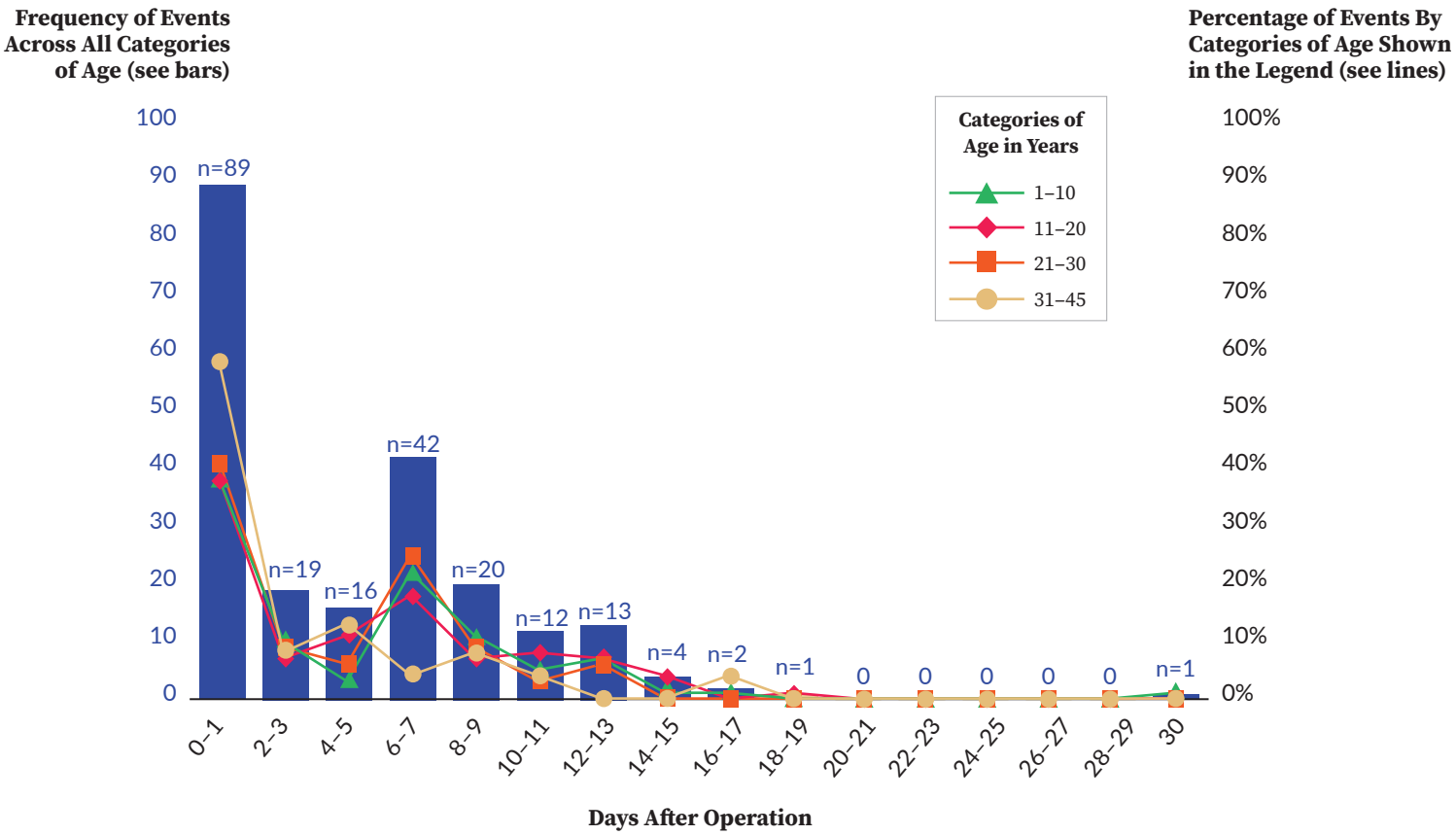
[d]These strategies are based on findings from our study and may help to advance patient safety. Inclusion of these strategies does not constitute an endorsement or formal recommendation by the authors or the Patient Safety Authority.

Table 2. Frequency of Post-T/A Return to Surgery for Uncontrolled Bleeding by Patient Age and Postoperative Days, N=219 PA-PSRS Event Reports

		Postoperative Days					
Patient Age (Years)	No. of Patients	Average	Minimum	25th Percentile	Median	75th Percentile	Maximum
1–5	38	4.2	0	0	3.5	7.25	13
6–10	49	5.5	0	0.5	6	8	30
11–15	38	4.4	0	0	3	8	14
16–20	38	5.2	0	0	6	8.25	18
21–25	17	4.5	0	0	5	8	13
26–30	15	3.7	0	1	3	6	9
31–35	7	3.6	0	0	2	9	10
36–40	14	3.2	0	0	1	5.5	16
41–45	3	0.0	0	0	0	0	0
Overall	**219**	**4.5**	**0**	**0**	**4**	**7**	**30**

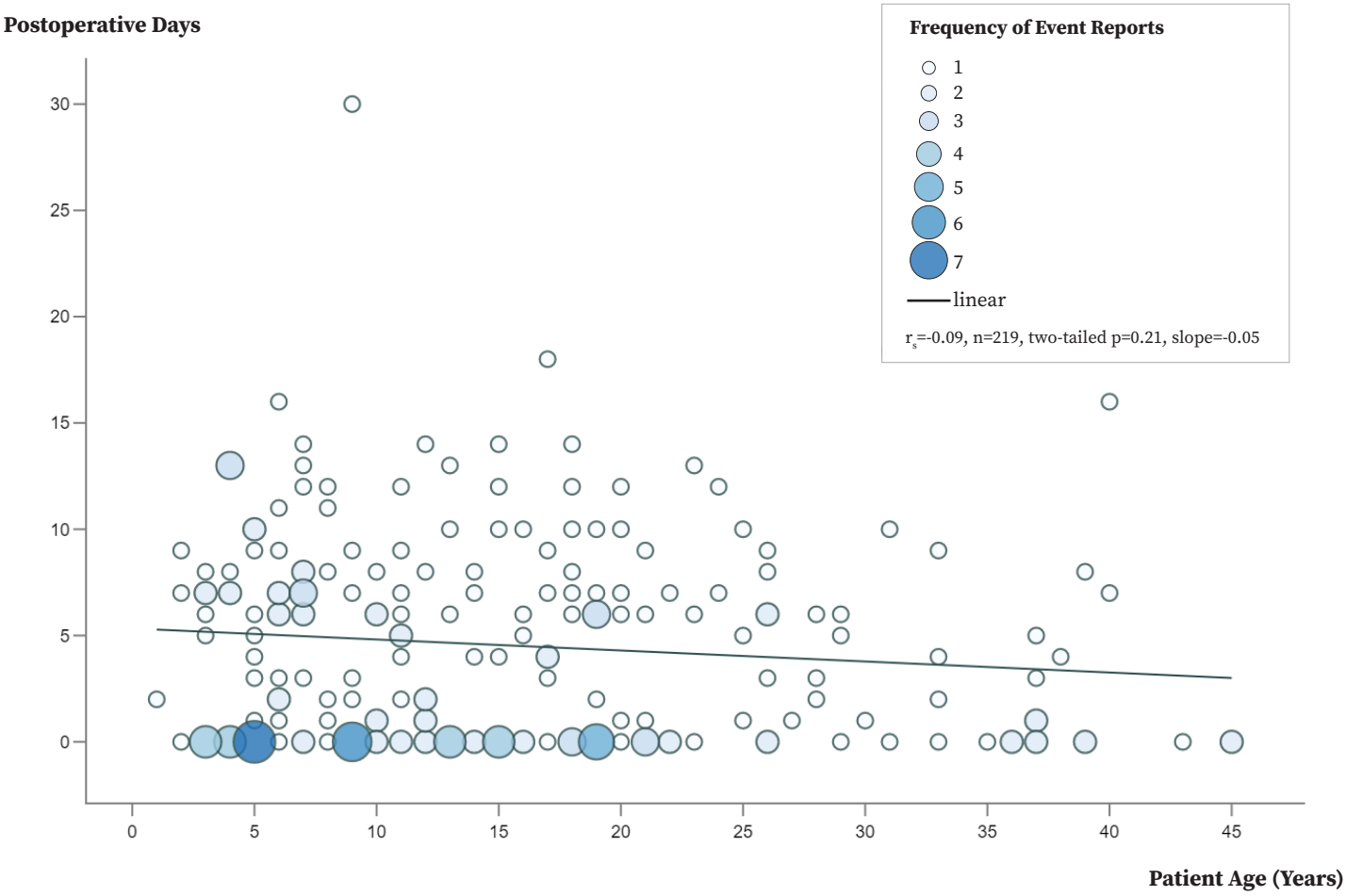
Note: The results shown in the "Overall" row were calculated from the raw data corresponding with each of the 219 event reports.

Figure 3. Post-T/A Return to Surgery for Uncontrolled Bleeding by Postoperative Days, N=219 PA-PSRS Event Reports



Note: The bars represent the *total frequency* of events by postoperative days across all categories of age. Each line represents one category of age and shows the *percentage* of events by postoperative days. The percentages for each line were calculated with a denominator dependent on the total number of events per age category: 1–10 years *n*=87, 11–20 years *n*=76, 21–30 years *n*=32, and 31–45 years *n*=24.

Figure 4. Frequency of Post-T/A Return to Surgery for Uncontrolled Bleeding, N=219 PA-PSRS Event Reports



Note: The color and size of data points reflect a frequency range of 1–7, with darker colors and larger sizes indicating a greater frequency. The linear trend line is based on the least squares method applied to all 219 data points. The notation identifies the correlation coefficient and associated p-value based on the Spearman's rank correlation.

We encourage future studies to use a greater sample size, if possible, as that might be necessary to achieve adequate statistical power. Overall, we encourage readers to use our findings, along with findings from previous research, to inform their practice and strategies to mitigate risk of patient harm.

Limitations

We chose not to calculate a rate of return to surgery post-T/A due to our concern for estimating an inaccurate rate. While licensed healthcare facilities in Pennsylvania are mandated to report events to the PA-PSRS database, it is likely that an unknown number of events go unreported and our inability to account for the underreporting would prevent us from estimating an accurate rate. Also, readers should note that instances of postoperative bleeding that involved patients who were identified as high-risk (e.g., diagnosed bleeding disorder) would not have been reportable to the PA-PSRS database if the increased risk was communicated to the patient/family prior to the procedure. Therefore, our sample of events likely is not representative of patients who were deemed high-risk (see **Methods** section for more information).

As an additional limitation, due to our lack of access to patients' medical records and billing codes, and a lack of specific details in many of the event reports, we were unable to account for the following variables in our study: indication for T/A procedure,[4,8,9,12,15,17,19,21,22,34] operative technique,[4,8,17,19,22,32,36,41,42] amount of blood loss during procedure,[6] duration of hospital stay,[19] antibiotic use,[4,17,19,34,43] steroid or nonsteroidal anti-inflammatory drugs,[11,21,33,34] diet,[44] dehydration,[10,14,27] body mass index,[8,12,19,22,34,35] and bleed onset time of day.[20,39]

Table 3. Review of Findings From Our Research and Previous Research to Evaluate Relation Between Variables and Patients' Postoperative Bleeding

Variables	Our Findings	Findings From Previous Research
Procedure	Tonsillectomy was described in 99.5% of the reports (218 of 219) and an adenoidectomy in 51% of the reports (112 of 219).	In previous studies, tonsillectomies were associated with nearly all of the bleeding events and we identified only three studies that also reported the percentage of events that involved adenoidectomies.[4,18]
Bleeding site	99% of reports (186 of 187) described bleeding at a tonsil and 1% at an adenoid (2 of 187).	We identified only one study that reported bleeding of adenoids and tonsils, and that study reported percentages similar to our study.[18]
Discharged before return to surgery	78% of reports (171 of 219) described the patient being discharged and then returning to surgery to control bleeding.	We did not identify any studies that explored the rate of discharge prior to returning for uncontrolled bleeding, across both primary and secondary bleeding.
Sex	53% of patients were reported as female and 47% were male.	Tonsillar bleeding occurred at a significantly greater rate with males than females in some studies[4,6,7,31-33] and in other studies there was a nonsignificant difference between sexes.[9,11,12,19,21,34]
Age	· Patient age was an average of 15.5 years, with a range of 1 to 45 years. · Majority of patients were age 3–20 years.	· Among the studies that reported frequency with a pediatric sample, the distribution of events by age was similar to our study.[4,11,15] · Some studies have shown a higher rate of post-T/A bleeding for adolescents than younger children.[5,8,10-14,32,34-36] · Among the adults who had a tonsillar procedure, they had a higher rate of postoperative bleeding than the young pediatric population.[4,9,13,32,35,36]
Primary vs. secondary bleed and postoperative days	· 41% of reports (89 of 219) described a primary bleed (days 0–1) and 59% (130 of 219) described a secondary bleed (days 2–30). · Across all reports, patients returned to surgery an average of 4.5 days after operation, with a range of 0 days (same day) to 30 days. · 0–1 days and 6–7 days after operation were the periods when the patients most frequently returned to surgery.	· Among the postoperative bleeds, secondary bleeding was most frequent in nearly all studies and consisted of 54%–100% of bleeds;[4-6,9,17,20-22,31] however, three studies reported that a greater percentage of their patients had a primary bleed.[11,18,37] · The most frequent periods of secondary bleeding varied across previous studies, but often occurred within 5–10 postoperative days.[5,6,9,11,14,20,27,33,34,38] · In most studies, the maximum number of postoperative days was often around 14–16 days,[6,7,9,11,20,34] but some studies reported a maximum as high as 18–19 postoperative days.[5,18, 25,38,39]
Age and postoperative days	· 42% (10 of 24) of the patients age 31–45 years had a secondary bleed, but a secondary bleed occurred with more than 59% of the patients in age categories of 1–10, 11–20, and 21–30 years. · During the secondary bleed period (days 2–30), patients age 31–45 years had the greatest rate of return during days 4–5; however, the other age categories had the greatest return rate during days 6–7. · During the secondary bleed period (days 2–30), patients age 31–45 years had less variability in percentage from one day to the next, which contrasts sharply with a relatively higher variability in the younger age categories. · Based on **Figure 4**, there was a relatively low frequency of events across days 2–5 for a majority of patient ages. · There was a small negative and nonsignificant relation between patient age and postoperative days. The linear trend line indicated that patients with a greater age are more likely to return to surgery in a shorter period after operation.	We identified one study that explored this topic and its data indicate that older patients tend to experience bleeding within a shorter postoperative period than younger patients.[9] In sharp contrast with our study, they reported zero instances of primary bleeding across all of their patients, which would suggest that there likely is an important difference between their research methodology and ours. As another important distinction, their study design was somewhat limited by presenting the findings by only two age groups: 15 years old or less (child group) and patients greater than 15 years (adolescent/adult group). Overall, their highly aggregated and limited presentation of their results prevented us from conducting a meaningful comparison.

Table 3 (continued).

Variables	Our Findings	Findings From Previous Research
Two or more instances of uncontrolled bleeding	· 3% of reports (6 of 219) described the patient returning to surgery twice to control tonsillar bleeding. · All 6 patients were male. · 4 of the 6 patients had their first and second return to surgery on different days	Among the studies that explored this topic, they reported that 1%–8% of patients experienced two or more postoperative bleeds.[4,9,25] Another study explored the topic and reported that the first and second bouts of bleeding occurred on different days,[38] which is aligned with our findings.
Month or season of secondary bleed	No systematic pattern of postoperative secondary bleeding by month or season.	A few studies reported no effect of month or season on postoperative bleeding;[7-9,19,39] however, other studies did find an effect related to month or season.[6,40]
Transfusion	1% of reports (3 of 219) described the patient receiving a blood transfusion.	0%–12% of patients received a blood transfusion due to post-T/A uncontrolled bleeding.[6,11,17,37]
Bleeding disorder	0% of reports (0 of 219) described the patient having a bleeding disorder.*	3% of patients were identified as having a bleeding disorder.[5]
Developmental disability	3% of reports (6 of 219) described the patient having a developmental disability.*	One study explored this topic and reported that 0% of the events were associated with a developmental disability; however, they did find a significant relation with attention-deficit/hyperactivity disorder (ADHD).[34]
Death	0% of reports (0 of 219) described a patient death related to the uncontrolled bleeding.	Previous studies reported either zero deaths associated with post-T/A uncontrolled bleeding[6,11] or a single death.[4,18,37]

Note: Our summary of previous literature is not exhaustive and is only intended to provide readers with a point of comparison.

*Events involving patients who were identified at high risk for uncontrolled bleeding would not have been reportable to the PA-PSRS database if the increased risk was communicated to the patient/family prior to the procedure.

We found a nonsignificant (p=0.078) relation between patient age (1–30 years, 31–45 years) and the type of bleeding (primary, secondary); however, our post hoc power analysis revealed that we had an inadequate sample size and insufficient power. Based on this finding, it is plausible that there is an underlying significant relation between patients age 31–45 years and a greater likelihood of a primary bleed, when compared to younger patients (for more information see the **Results** section).

Conclusion

We urge healthcare staff to use our findings, along with those from previous research, to better understand the variables associated with post-T/A uncontrolled bleeding. Staff should consider the information highlighted in **Table 3**, which could be used to identify patients who might be at higher risk for uncontrolled bleeding. In particular, our findings indicate that the post-T/A timing of uncontrolled bleeding may vary systematically as a function of patient age; however, future research is needed to better understand this topic. While identification of patient risk likely is a necessary component of an effective intervention program, it is also likely that a multifaceted intervention package would be required to significantly reduce the rate of uncontrolled bleeding and patient harm. An evaluation of interventions was beyond the scope of this study; nevertheless, we believe that understanding how risk varies across the population is fundamental to selecting and developing a cost-effective intervention to reduce patient harm.

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Notes

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