Tonsillectomy in Adults – Increased Pain Scores are Correlated with Risk of Bleeding

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May 12, 2022

Abstract

Objective: Tonsillectomy is one of the most common surgeries worldwide, mostly indicated for recurrent throat infections and sleep-disordered breathing. The most significant complication is post-tonsillectomy bleeding. Although several risk factors for post-tonsillectomy bleeding in adults have been described, the role of post-operative pain as a risk factor for hemorrhage has not been described in this patient population. Design: Retrospective cohort study of adult patients (18 years and older) who underwent tonsillectomy in a tertiary referral center. Multi-variable logistic regression model was used to test correlation between the independent variables and post-tonsillectomy bleeding. Results: 305 patients (male to female ratio 1:1) with a mean age of 30.5 years old (18-82, ± 12). Mean body mass index was 26.6 (16-42, ±5) and 13% of patients were current smokers. Post-tonsillectomy pain on post-operative day 1 and 2 was associated with increased risk of bleeding (adjusted odds ratio 2.18, 95% confidence interval 1.73-2.44). Other factors that were associated with increased risk of post-tonsillectomy bleeding were male sex, young age (18-30 years old), smoking, recurrent throat infections as an indication for surgery and the usage of hot technique ($p < 0.05$). Conclusions: Increased post-operative pain following tonsillectomy is associated with increased risk of bleeding in adults. Other factors such as younger age group, males, smoking, previous throat infections and using hot dissection technique are also associated with risk of post-tonsillectomy bleeding. Further studies should explore the effect of strict pain control regimens on post-tonsillectomy bleeding in adults.

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Conclusions: Increased post-operative pain following tonsillectomy is associated with increased risk of bleeding in adults. Other factors such as younger age group, males, smoking, previous throat infections and using hot dissection technique are also associated with risk of post-tonsillectomy bleeding. Further studies should explore the effect of strict pain control regimens on post-tonsillectomy bleeding in adults.

Key words: tonsillectomy, bleeding, post operative pain

Key points:

- Tonsillectomy is one of the most common surgeries worldwide, mostly indicated for sleep-disordered breathing and recurrent throat infections
- Post-tonsillectomy bleeding is the most significant complication, reported in 0.2-20% cases and may lead to suffocation, airway obstruction and death
- Although several risk factors for post-tonsillectomy bleeding are described in adults, the role of post-operative pain score was not investigated
- Higher post-operative pain score (measured in visual analogue scale) on post-operative days 1 and 2 were associated with risk of bleeding in adults
- Further prospective studies should explore the effect of strict pain control regimens on post-tonsillectomy bleeding in adults

1. Introduction

Tonsillectomy is one of the most common surgical procedures worldwide. According to the most recent National Health Statistics Report, published in 2017, over 390,000 tonsillectomies were performed in United States, 102,000 of them were in ages 15-44 years old [1]. The most common indications for tonsillectomy in adults are recurrent throat infections (with or without suppurative complications such as peritonsillar abscess), sleep-disordered breathing and obstructive sleep apnea (OSA) [2].

Tonsillectomy can be performed through several techniques; Cold dissection techniques uses sharp dissector with a tonsil knife, scalpel and scissors, while hot dissection make use of cautery. Hot techniques may be associated with increased postoperative pain and longer healing times [3-4]. Radiofrequency ablation (i.e, coblation) is a technique which uses lower temperatures giving rise to less thermal injury and potentially less postoperative pain. A Cochrane review of 9 trials that compared coblation with other techniques found no significant differences in pain and speed of recovery between the different techniques [5].

The most common post-tonsillectomy complications are nausea and vomiting, dehydration, pain and bleeding. Post-tonsillectomy bleeding (PTB), the most significant complication, usually occurs in 0.28% to 20% of cases [6] and may rarely lead to suffocation, airway obstruction, hemorrhagic shock and death [7]. Primary PTB occurs within the first 24 hours and is usually related to surgical technique, while delayed bleeding occurs later, usually within the first 10 days—most commonly on the sixth or seventh day and is attributed to the slough of eschar [8].

Studies suggested that risk factors for PTB are indication for surgery, obesity, surgical technique and smoking status, amongst others [9-18]. However, only a few of these studies were conducted in the adult population.

Post-operative pain was shown in the pediatric population to be associated with increased PTB risk [20-24]. There have been no studies examining this correlation in the adult population. The aim of our study was to delineate the risk factors for PTB in the adult population, with special emphasis on post-operative pain scores.

2. Methods and Patients

This was a single tertiary referral center retrospective cohort study. The study was approved by the local institutional review board (0403-21-RMB-D). Inclusion criteria were patients aged 18 years old or older, who underwent tonsillectomy or tonsillotomy (with or without uvulopalatopharyngoplasty [UPPP]) between 2015-2022. Patients' medical records were reviewed.

Post-tonsillectomy bleeding was defined as any instance of fresh blood discharge through the mouth, either reported by the patient or seen by medical stuff. This included any bleeding ranging from a few drops of blood to major hemorrhage with hemodynamic compromise. We decided on this broad definition in order to minimize the chance for interobserver variability on declaring PTB.

All patients were admitted after the operation for at least 2 days. Post-operative pain was assessed by VAS (0 to 10) by the department nurse at least once in an 8-hour shift and recorded in the medical records.

After discharge all patients were scheduled an outpatient clinic visit 2 weeks after the operation. During that visit the patients were questioned regarding episodes of PTB (even if they occurred in another hospital) and the answers were documented in the medical record.

Descriptive analysis of quantitative variables was demonstrated using mean, standard deviation and range. Categorial variables were described with prevalence and percentage. Quantitative groups were compared by independent sample t-test or Wilcoxon rank sum test (according to sample size and distribution). Qualitative data were compared using Chi-square test or Fisher's exact test. Multi-variable logistic regression model was used to test correlation between the independent variables and PTB (variables that were correlated to PTB in a statistically significant manner in the univariable analysis). Co-linearity was excluded. Results are shown as adjusted odds ratio. Power of the correlation between qualitative variables was tested using Cramer's coefficient. A p-value less than 0.05 was considered statistically significant.

Statistical analysis was performed using SPSS © 24.0 software for Windows.

Transparent reporting of a multivariable prediction model for individual prognosis or diagnosis (TRIPOD) guidelines has been followed in this study.

There are no sources of funding to disclose for this study.

The authors declare they did not have any conflicts of interest.

3. Results

Between 2015-2022 a total of 305 adult patients met the inclusion criteria.

We included patients who underwent tonsillectomy (232 patients), tonsillotomy (intracapsular tonsillectomy) (31 patients) and tonsillectomy with UPPP (42 patients), as described on Table 1.

Age distribution and indication for surgery are depicted on Figures 1 and 2, respectively. Male to female ratio was 1:1 with a mean age of 30.5 years old (18-82, ± 12) and mean BMI of 26.6 kg/m^2 (16-42, ± 5). Thirty-nine patients (13%) were current smokers. Patients who underwent tonsillectomy with UPPP were more likely to be older males who smoke, with higher BMI scores. The indication for their surgery was exclusively OSA. Surgical technique was cold dissection in 238 patients (79%), hot dissection in 36 patients (12%) and coblation (radiofrequency) in 25 patients (9%). In 31 patients (10%) sutures were used: in 13 patients the sutures were between the pillars while in 18 patients it was used for hemostasis at the tonsillar bed. Post-operative pain scores on the visual analogue scale (VAS) and rates of PTB were similar between tonsillectomy with and without UPPP, but both were lower in the tonsillotomy group.

In our cohort, 49 patients (16%) had PTB, as described in Table 2. 6 patients (12%) had Primary PTB (within 24 hours of surgery) while the rest, 43 patients (88%), had secondary PTB (later than 24 hours post-operatively). Conservative treatment was sufficient in 30 patients (62%) and 19 patients (38%) needed control of hemorrhage in the operating rooms. Eight patients (16%) had multiple hemorrhages and 4 of them required multiple interventions to control the bleeding.

A multi-variable logistic regression was used to test correlation between the independent variables and PTB in order to find factors that are associated with bleeding, as depicted on Figure 3.

At the younger age group (18-30 years old) 15.5% of patients developed PTB, compared to 3.9% in older patients (+ 30 years old) (adjusted odds ratio [OR] 3.9, 95% confidence interval [CI] 2.1-6.7). Fourteen percent of males developed PTB compared to 8.2% in females, with the OR for a male to develop PTB being 1.71 (95% CI 1.01-2.92). Smoking was associated with higher rates of PTB, with 19.2% of smokers developed PTB compared to 10.5% in non-smokers (OR 1.8, 95% CI 1.36-3.42). When comparing the indication for surgery, it was found that patients with recurrent throat infections as indication for surgery developed PTB in 23.3% of cases compared to 10% in patients with OSA (OR 2.32, 95% CI 1.83-4.2). Surgical technique

also had effect on bleeding risk – 19% of patients who underwent surgery using hot dissection technique developed PTB, compared to 11% in cold and coblation groups together (OR 1.7, 95% CI 1.1-2.5).

Mean VAS scores of all patients on POD-0, POD-1 and POD-2 were 2.4, 4.6, 3.2, respectively. Post-operative VAS on day 1 and 2 were higher in patients with PTB, as depicted on Figure 4 (OR 2.18, 95% CI 1.73-2.44). Every increase of 1 unit in VAS score, increases the risk of PTB in 6% ($p < 0.05$).

Most patients (94%) were discharged by POD-3 and majority (72%) on POD-2. 95% of the patients arrived for their scheduled outpatient clinic follow-up. Only 5% were lost to follow-up. All were questioned whether they had any type of PTB. Of them, 250 (86%) felt better and 40 (14%) were still having some pain

4. Discussion

Tonsillectomy is one of the most common surgeries worldwide. As 26% of tonsillectomies in United States are performed in adults [1], the purpose of this study was to find factors that are associated with PTB with a focus on post-operative pain, a factor which has not been investigated in the adult population.

In this cohort, younger patients had a higher risk of PTB compared to patients over 30 years old. Although there is abundant data regarding the fact that adults have higher tendency for PTB compared to pediatric patients [9], in this study we highlight a specific sub-group at higher risk of PTB, namely those in the 18 to 30 age group.

Similar to previous studies [10-13], males and smoking status were associated with PTB. In this cohort BMI was higher in the PTB group but the difference was not statistically significant. Regarding surgical technique, some studies demonstrated higher bleeding rates with hot dissection technique [14-15], while others found no association, including one Cochrane review [9, 16]. In our study we found a correlation between the use of hot technique and higher bleeding rates. Sutures were unhelpful in reducing the probability of PTB in this cohort.

Patients who underwent tonsillectomy due to recurrent throat infections were more likely to develop PTB, compared to other indications (OSA, halitosis etc.). This is probably due to the fibrosis and scaring in the peritonsillar tissue following recurrent inflammatory states which leads to difficulties with the dissection from the tonsillar bed. This finding was also noted in the pediatric population [18].

Post-operative pain was measured as VAS (1-10) from POD-0 to POD-2 and higher scores on POD-1 and POD-2 were associated with PTB. To the best of our knowledge, this is the first study that implies a relationship between post-operative pain and PTB in the adult population. One hypothesis is that pain reaction involves several mechanisms that lead to increased risk of bleeding. First, surgery induces inflammatory states that results in increase of inflammatory cytokines which lead to vasodilation [19]. Second, uncontrolled pain may lead to anxiety and stress response, both may cause increase in respiratory rate and blood pressure which results in bleeding. Third, increased pain can cause reduced oral intake and dehydration which may impair wound healing and lead to bleeding. On the other hand, this study cannot rule out that pain and PTB are not causally related, but rather have a common cause. One option is that a more difficult operation (e.g., due to recurrent infections) may lead to both higher pain scores and increased risk for PTB. To account for this possibility, a sub-group analysis of correlation between pain and PTB was performed according to indication. There was no difference in our results when analyzing by indication. This analysis cannot completely rule out a common causative agent for increased post-operative pain an PTB risk. A prospective trials that measure the effect of intensive pain control on bleeding risk may clarify the issue. Regardless of causality, increased post-operative pain may serve as a predictor for future bleeding.

This study is mainly limited by its retrospective nature. Tonsillectomies were performed by 3 different surgeons thus small differences in the surgical techniques were encountered. Patients received different types of analgesics (paracetamol, dipyrone, tramadol, oxycodone, non-steroidal anti-inflammatory drugs) and for most of the trial period, there was no uniform protocol for pain control.

5. Conclusion

Post-operative pain following tonsillectomy was associated with increased risk of PTB in adults. Other factors that were associated with PTB in adults were younger age group (<30 years of age), male gender, smoking, previous throat infections and using hot dissection technique. Further prospective studies should explore the effect of strict pain control regimens on PTB in adults.

6. Supplementary files

Figure 1 – Age distribution of cohort

Figure 2 – Indication for tonsillectomy

Figure 3 – Forest plot of variables and post tonsillectomy bleeding

Figure 4 – Post-operative Visual Analogue Scale of patients with and without post-tonsillectomy bleeding

Table 1 – Demographics and clinical characteristics

Table 2 – Comparison between patients with and without post tonsillectomy bleeding

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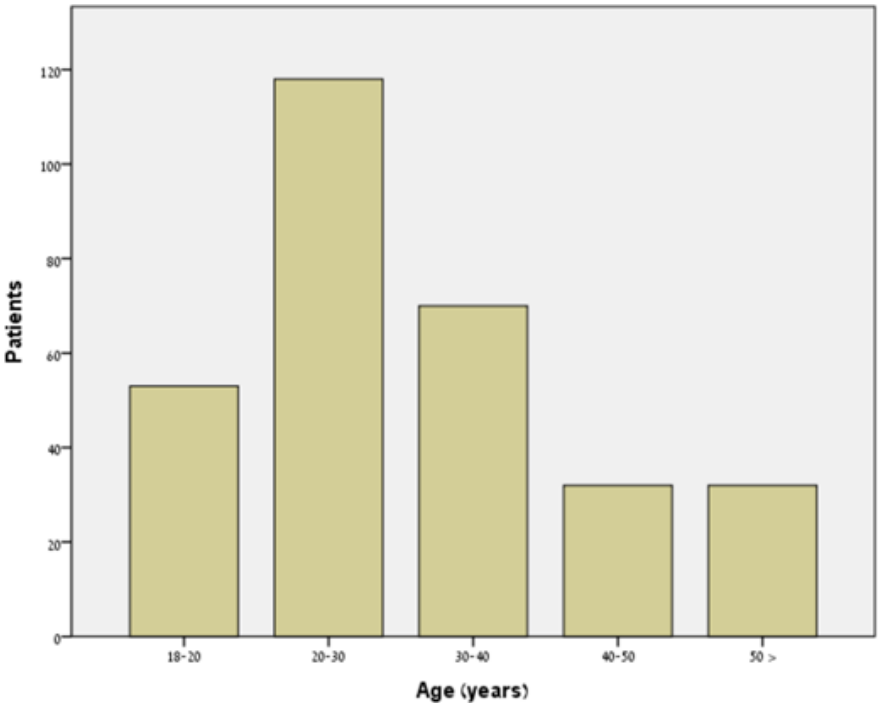

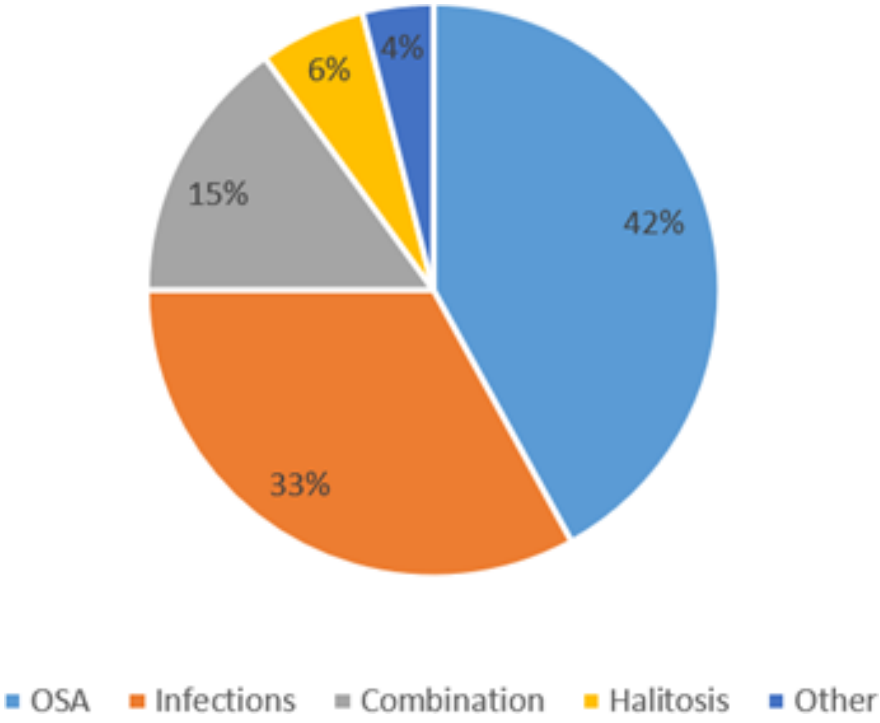

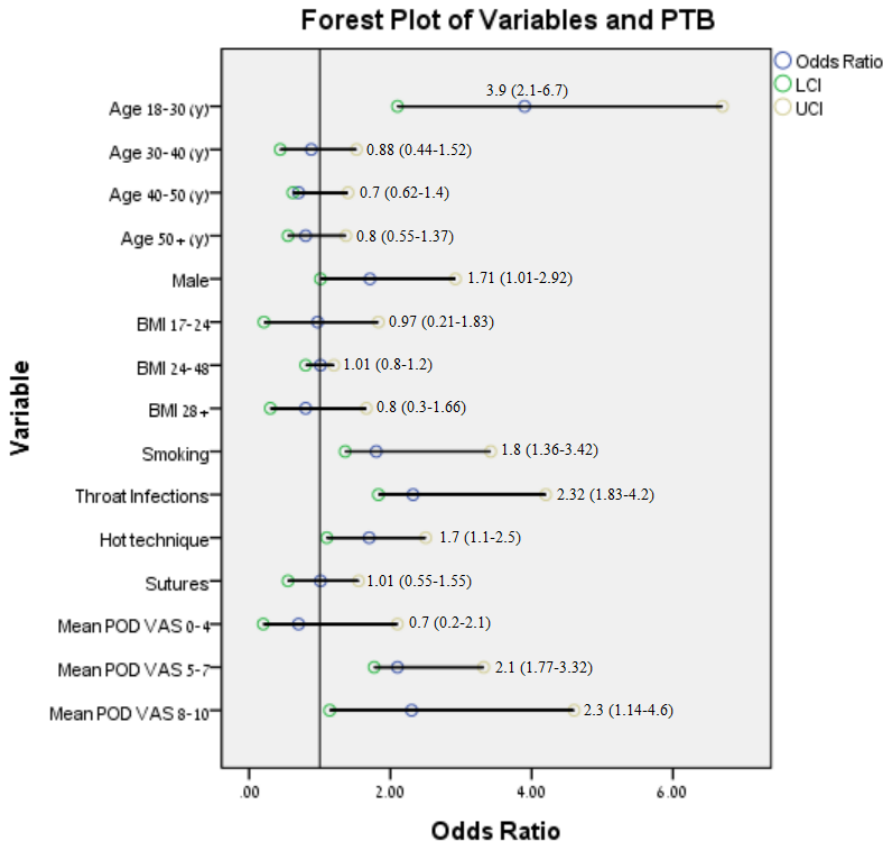

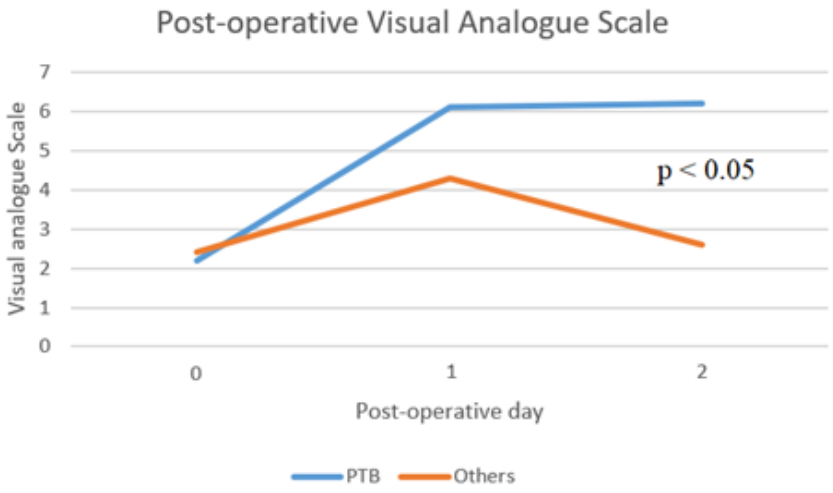

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