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Frequency of Secondary Hemorrhage Post Tonsillectomy by Dissection and Ligation Method Using Silk 2.0 for Hemostasis

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ABSTRACT

Hemorrhage is one of the most common and serious complications in post-tonsillectomy follow-up. **Objective:** To find the frequency of post-tonsillectomy hemorrhage using silk 2.0 for hemostasis. **Methods:** A cross-sectional analytical study was conducted at the Department of Otorhinolaryngology, District Headquarter Teaching Hospital, Gujranwala, from April 2025 to December 2025. 109 patients aged 5-14 years diagnosed with chronic tonsillitis underwent bilateral tonsillectomy by Dissection and Ligation with 35-40 minutes of Surgery duration under general anesthesia. Hemostasis was achieved exclusively using Silk 2.0 suture ligation. Patients were monitored for 28 days postoperatively for evidence of secondary hemorrhage. Data were analyzed using SPSS version 25.0. Quantitative variables were presented as mean ± standard deviation, while categorical variables were expressed as frequency (%). Post-stratification Chi-square testing was performed, and p≤0.050 was considered statistically significant. **Results:** The mean age was 9.36 ± 2.949 years. Mean BMI was 22.30 ± 2.34 kg/m2. Gender distribution showed that there was female predominance, i.e., 63 (57.8%) were females. Mean duration of disease was 2.39 ± 1.162 years. Out of 109 patients, 11 (10.1%) developed secondary hemorrhage. The data were stratified according to age, gender, BMI, and duration of disease, and results showed that there was no difference between stratification groups in terms of frequency of secondary hemorrhage (p value>0.050). **Conclusions:** Secondary hemorrhage after bilateral tonsillectomy by Dissection and Ligation is 10.1% by using silk 2.0 suture for hemostasis. The larger studies with the addition of control groups would provide deep insight into the true significance.

INTRODUCTION

The most dangerous and potentially fatal complication of tonsillectomy remains post-tonsillectomy hemorrhage, which significantly increases postoperative morbidity and healthcare costs [1, 2]. Secondary hemorrhage, defined as bleeding occurring more than 24 hours after surgery, is especially concerning because it typically manifests between postoperative days 5 and 10 and may necessitate emergency care, hospital readmission, blood transfusion, or surgical re-exploration [3, 4]. Despite improvements in surgical care, secondary bleeding remains clinically relevant, as recent studies report rates ranging from 1% to 5% [5, 6]. The frequency of post-tonsillectomy hemorrhage varies considerably and is influenced by multiple factors, including patient characteristics, perioperative care, and most importantly, the surgical technique and intraoperative hemostasis [4, 7]. A recent meta-analysis (2025) demonstrated that secondary hemorrhage rates differ significantly among surgical techniques, with rates reported as high as 5.8%, and a higher risk associated with thermal methods such as bipolar diathermy compared to cold dissection techniques [8]. The importance of selecting an appropriate

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hemostatic method is further emphasized by regional studies that have demonstrated higher bleeding rates with thermal techniques [6, 9]. During tonsillectomy, various hemostatic methods are employed, including electrocautery, coblation, pressure packing, topical agents, and suture ligation [8]. Although thermal techniques are frequently used due to their efficiency, they are associated with tissue necrosis and delayed eschar separation, which may increase the risk of secondary hemorrhage [5]. In contrast, mechanical techniques such as suture ligation may provide more stable vascular control and avoid thermal injury, thereby potentially reducing the risk of delayed bleeding. Despite mounting evidence regarding various hemostatic approaches, there remains a significant gap in the literature evaluating Silk 2.0 as a sole hemostatic modality in tonsillectomy, particularly in pediatric populations. Most recent studies either compare multiple techniques, focus on primary hemorrhage, or evaluate postoperative pain rather than secondary bleeding outcomes [8]. Additionally, there is a lack of regional data regarding the safety and efficacy of Silk 2.0 in preventing secondary hemorrhage, which limits its evidence-based implementation in routine practice [9, 10]. This study generated institution-based data regarding the safety and clinical outcomes of this technique, supports evidence-based selection of hemostatic methods, and contributes to the development of standardized surgical protocols to reduce postoperative hemorrhagic complications.

There are no recent comparative secondary hemorrhage rates published in Pakistan after tonsillectomy with silk ligation and other types of hemostatic techniques (electrocautery, cold dissection, thermal welding), and most of the local studies are on primary hemorrhage or combined procedures. There is no randomized controlled study that compared Silk 2.0 with absorbable sutures or non-suture methods in children. The sample is not representative of the real-world population due to the exclusion of patients with clotting disorders, diabetes, hypertension, and other comorbidities, which are prevalent in the real-world population. This study aims to determine the frequency of secondary hemorrhage following tonsillectomy using Silk 2.0 for hemostasis.

METHODS

This analytical cross-sectional study was conducted at the Department of ENT, District Headquarter Teaching Hospital, Gujranwala, from April 2025 to December 2025. The ethical approval was taken from the institutional review board with ref no: 21/GMC. The sample size of 109 patients was calculated using the WHO sample size calculator. The frequency of secondary hemorrhage was taken as 11.5 [11]. The confidence level was 95%, and the margin of error was kept at 5%. Both male and female patients with chronic tonsillitis (more than 7 episodes in a year, more than 5 episodes in 2 consecutive years, and or more than 3 episodes in 3 consecutive years) and an age range of 5 to 14 years were included in this study. Patients with active infection, if any, bleeding or clotting factors disturbed, informed consent refusal, anemia, leukopenia, any active hepatitis, diabetes mellitus, ischemic heart disease, hypertension, chronic renal, liver, or pulmonary disorders were excluded. After permission from the institutional ethical committee and concerned authorities, informed written consent was taken from all patients or guardians. After collecting demographic details, a complete history, a detailed clinical examination, and necessary laboratory investigations were carried out. The patients underwent bilateral tonsillectomy by the dissection and Ligation method done by the same consultant in a total duration of 35-40 minutes under standard general anesthesia using Silk 2.0 for hemostasis. The secondary hemorrhage was assessed during the 28 days in the postoperative period by a researcher trainee. All patients were managed as per hospital protocols.

Data were analyzed using SPSS version 25.0. Mean ± standard deviation was used for the expression of quantitative variables like age, BMI, and duration of symptoms. Frequency and percentages were used for the expression of qualitative variables like gender and secondary hemorrhage. Post-stratification Chi-square test was applied. A p-value of ≤0.050 was considered statistically significant.

RESULTS

The mean age of the patients was 9.36 ± 2.949 years. The mean body mass index (BMI) was 22.30 ± 2.34 kg/m^2. Females constituted 63 (57.8%) of the study population. The mean duration of disease was 2.39 ± 1.162 years. Overall, secondary hemorrhage occurred in 11 (10.1%) patients out of 109 during the 28-day follow-up period. Stratified analysis was performed to assess the association between secondary hemorrhage and age, gender, BMI, and duration of disease. No statistically significant association was observed between age group and secondary hemorrhage (p=0.420) (Table 1).

Table 1: Association of Secondary Hemorrhage with Age

Variable		Age		Total	p-value
		<9 Years, n (%)	≥9 Years, n (%)		
Hemorrhage	Yes	5 (8.1)	6 (12.8%)	11 (10.1)	0.420
	No	57 (91.9)	41 (87.2)	98 (89.9%)	

The frequency of secondary hemorrhage according to gender is shown. Secondary hemorrhage occurred in 2 (4.3%) males and 9 (14.3%) females. The difference was not statistically significant (p=0.089) (Table 2).

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Table 2: Association of Secondary Hemorrhage with Gender

Variable		Gender		Total	p-value
		Male, n (%)	Female, n (%)		
Hemorrhage	Yes	2 (4.3%)	9 (14.3%)	11 (10.1%)	0.089
	No	44 (95.7%)	54 (85.7%)	98 (89.9%)	

The relationship between BMI categories (<23 kg/m^2 and ≥23 kg/m^2) and secondary hemorrhage is presented. Secondary hemorrhage was observed in 6 (8.2%) patients with BMI <23 kg/m^2 and 5 (13.9%) patients with BMI ≥23 kg/m^2. There was no statistically significant association (p=0.355)(Table 3).

Table 3: Association of Secondary Hemorrhage with BMI

Variable		BMI		Total	p-value
		<23 kg/m^2, n (%)	≥23 kg/m^2, n (%)		
Hemorrhage	Yes	6 (8.2%)	5 (13.9%)	11 (10.1%)	0.355
	No	67 (91.8%)	31 (86.1%)	98 (89.9%)	

The association between duration of disease (<2.5 years and ≥2.5 years) and secondary hemorrhage is shown. Hemorrhage occurred in 7 (12.3%) patients with disease duration <2.5 years and 4 (7.7%) patients with duration ≥2.5 years. No statistically significant association was identified (p=0.427).

Table 4: Association of Secondary Hemorrhage with Duration of Disease

Variable		Duration of Disease		Total	p-value
		<2.5 Year, n (%)	≥2.5 Years, n (%)		
Hemorrhage	Yes	7 (12.3%)	4 (7.7%)	11 (10.1%)	0.427
	No	50 (87.7%)	48 (92.3%)	98 (89.9%)	

DISCUSSION

Secondary post-tonsillectomy hemorrhage remains the most clinically significant complication following tonsillectomy, often necessitating urgent intervention and contributing substantially to postoperative morbidity. Within 28 days, 11 out of 109 patients (10.09%) in the current study had secondary bleeding, which is within the upper range of rates reported globally (3–10%) and is still in line with modern surgical results [12, 13]. This result suggests that using Silk 2.0 for ligation yields a hemostatic profile that is on par with accepted surgical norms. Numerous studies have examined how the surgical approach and hemostatic method affect delayed bleeding. When opposed to heat procedures, mechanical hemostasis techniques like ligation and suturing are linked to less collateral tissue damage, maintaining vascular integrity. Suturing considerably lowers postoperative bleeding after coblation tonsillectomy, as Liu *et al.* showed [14]. Additionally, intraoperative suturing is linked to a lower incidence of post-tonsillectomy bleeding, according to Li *et al.* comprehensive review and meta-analysis, which supports the efficacy of mechanical hemostatic procedures [15]. These results support the idea that the risk of subsequent bleeding might be decreased by limiting heat damage and guaranteeing tight vascular ligation. Secondary hemorrhage is a complex phenomenon, even with sufficient surgical hemostasis. According to recent research, outcomes are greatly influenced by variables such as surgical technique, intraoperative hemostasis, and postoperative wound healing [12, 16]. No statistically significant correlation was found in the current study between secondary hemorrhage and demographic factors, including age, gender, BMI, or length of illness. These results are in line with those of Gonçalves *et al.* who found that in pediatric populations, demographic traits did not independently predict delayed bleeding [17]. On the other hand, Inuzuka *et al.* showed that growing older may be linked to an increased risk of post-tonsillectomy bleeding in adults, indicating variation among various populations and age groups [13]. This discrepancy suggests that surgical variables should be considered when interpreting patient-related factors alone, since they may not be a reliable predictor of bleeding risk. Secondary bleeding has a complicated etiology that includes local tissue healing mechanisms. When fibrinolysis and inflammatory activities reveal previously sealed arteries, delayed bleeding usually happens during the eschar separation phase. Perioperative pharmacological factors have also been studied; Patel *et al.* found that intraoperative intravenous ibuprofen does not significantly increase the risk of post-tonsillectomy hemorrhage, indicating that analgesic protocols may not be a major factor in delayed bleeding [18]. Additionally, as chronic tonsillitis is linked to biofilm formation and altered tonsillar microbiota, which may hinder healing and increase the risk of delayed bleeding, microbiological variables also play a part [19, 20]. The non-absorbable braided nature of Silk 2.0 may potentially cause a localized inflammatory response even if it offers safe mechanical ligation. Current research, however, indicates that the degree of hemostasis attained intraoperatively is more important than the type of suture material [12, 16]. Rather than the effect of suture material alone, the bleeding rate seen in this study probably reflects a combination of surgical precision, tissue handling, and individual healing response. The lack of statistically significant differences between stratified variables is a key finding in this study that emphasizes how unpredictable secondary bleeding is by nature. This unpredictability emphasizes that all patients, regardless of their initial features, require careful postoperative monitoring and precise surgical technique. Nevertheless, the lack of multivariable analysis makes it more difficult to find independent predictors and possible confounders. Now withstanding these drawbacks, this study offers important institution-specific data on the only application of Silk 2.0

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for tonsillar hemostasis. These results help fill a significant vacuum in the literature because there aren't many recent studies that explicitly assess silk ligation. Furthermore, the observed rate of bleeding, which is similar to data from other countries, encourages the ongoing application of dissection and ligation procedures in patients who have been carefully chosen. In order to better identify independent predictors of secondary bleeding, future research should concentrate on carefully planned randomized controlled trials comparing various hemostatic methods and suture materials, as well as multivariate analysis. These investigations might aid in improving surgical techniques and lowering the frequency of this clinically important consequence.

Limitations include the absence of a comparative control group, lack of multivariable regression analysis, and a single-center design. Future analytical studies with larger sample sizes and direct comparison between Silk 2.0 and alternative hemostatic methods would better determine its relative efficacy and independent impact on secondary hemorrhage.

CONCLUSIONS

The frequency of secondary hemorrhage following bilateral tonsillectomy by the Dissection and Ligation method using Silk 2.0 for hemostasis was 10.1%. No statistically significant association was observed between secondary hemorrhage and age, gender, body mass index, or duration of disease.

Authors' Contribution

Conceptualization: NA
Methodology: SH, AJF
Formal analysis: NA, AA
Writing and Drafting: NA, AR, SR
Review and Editing: NA, SH, AA, AR, AJF, SR

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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