JSRMBS
Journal of Scientific Research in Medical and Biological Sciences
ISSN 2709-0159(print) and ISSN 2709-1511 (online)
Volume 7, Issue 1 Article 1
DOI: https://doi.org/10.47631/jsrmbs.v7i1.1083

Incidence of Post Tonsillectomy Bleeding between Harmonic versus Cold steel Techniques: A Comparative Study

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ARTICLE INFO

Recieved: 21 Dec 2025
Revised: 19 Jan 2026
Accepted: 08 Feb 2026

Keywords:
Post Tonsillectomy Bleeding
Harmonic Scalpel
Cold Steel Technique

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ABSTRACT

Tonsillectomy is one of the most commonly performed otolaryngological procedures. Post-tonsillectomy bleeding remains the most significant complication and may occur in the early or late postoperative period, leading to increased morbidity and hospital readmission. To compare the incidence of post-tonsillectomy bleeding between conventional (cold steel) and ultrasonic techniques (harmonic). This comparative interventional study was conducted at two hospitals in Babylon government Al-Hilla Teaching Hospital and Al-Imam Al-Sadiq Hospital over a 12-month period from October 2024 to October 2025.A total of 260 patients underwent tonsillectomy were included. Patients were divided into two groups: (1) Group 1: 130 patients that were treated with Cold-steel dissection; (2) Group 2: 130 patients that were treated with Harmonic (ultrasonic) dissection. Data collected included age, sex, indication for surgery, surgical technique, season of surgery, occurrence and timing of post-tonsillectomy bleeding, and initial management. Statistical analysis was performed using appropriate tests, with a p-value < 0.05 considered to be statistically significant. Post-tonsillectomy bleeding occurred in 13 patients (5%). Secondary bleeding (≥24 hours) was more common than primary bleeding. A statistically significant association was observed between post-tonsillectomy bleeding and the primary surgical technique, as well as obstructive sleep apnea as an indication for surgery. Age, sex, and season showed no statistically significant association with bleeding. Most of secondary bleeding episodes (8 patients) were managed conservatively and (2 patients) were managed surgically, while all primary bleeding (3 patients) required operative intervention. Harmonic tonsillectomy appears to be associated with a higher incidence of post-tonsillectomy bleeding compared to the cold steel technique, particularly regarding secondary bleeding.

INTRODUCTION

Tonsillectomy is one of the most common surgical procedures performed in the pediatric population worldwide. The indications for tonsillectomy, with or without adenoidectomy, vary; however, recurrent tonsillitis and obstructive sleep-disordered breathing remain the two most common indications (Houborg & Klug, 2022).

Despite its high frequency, tonsillectomy carries risks and complications, including bleeding, respiratory distress, pain, fever, nausea, vomiting, and dehydration. Post tonsillectomy readmission rates range from 3.6% to 16.6% and contribute significantly to hospital admissions. In

a recent study investigating the leading causes of readmission following the procedure, bleeding was identified as the second most common cause, after poor oral intake, accounting for 49.4% of their readmitted patients. Post tonsillectomy bleeding represents a significant challenge in pediatric patients worldwide, with incidence rates ranging from 0.2% to 11.9% (Alsalamah et al., 2024).

Post tonsillectomy bleeding is typically classified into primary and secondary bleeding. Primary bleeding occurs within the first 24 hours following surgery and is often attributed to factors such as ineffective hemostasis during the intraoperative phase, which may result in rebleeding from small-caliber arteries. Conversely, secondary bleeding arises beyond the initial 24-hour period and is frequently associated with impaired wound healing and premature sloughing or separation of eschar. Both primary and secondary post tonsillectomy bleeding can be complicated and can potentially lead to fatal consequences. However, primary post tonsillectomy bleeding is generally considered more hazardous due to increased risk of aspiration, laryngospasm, and circulatory collapse from insensible swallowed blood loss (Ikoma et al., 2014; Xu et al., 2021).

History of tonsillectomy

The Roman doctor Cornelius Celsus, in the first century before Christ, was the first one to describe a tonsillectomy doing the surgical procedure with his own finger for dissection and removal of the structures (Abrams, 2017). Duverney, in 1761, made the first accurate description of the pharyngeal region, but detailed anatomical and histologic studies only had been realized in the 19th century by Wilhelm Von Waldeyer (Moore et al., 2018). Physick in 1828 introduced instruments for the fast accomplishment of the tonsillectomy. In Brazil, the first surgery was realized in the decade of 1920 by a surgeon in the Santa Casa of Sao Paulo, Schmidt Sarmento. Currently the tonsillectomy is the most realized surgical procedure in children in the world. New methods, including lasers and electrosurgery, are continuously being developed and studied to improve the surgical technique and to diminish pain and discomfort associated with this-procedures.

Embryology

Palatine tonsils developed from pouch two which begins during the fourteenth week of gestation (Moore et al., 2018).

Anatomy of palatine tonsil

Waldeyer's ring

Waldeyer's ring arranged in a circumferential configuration in the nasopharynx and oropharynx (Fossum et al., 2017). Positioned at the common entry of the respiratory and alimentary tracts, Waldeyer's ring plays a unique role in filtering exogenous antigens, as well as in the initiation and maintenance of immune responses (Fossum et al., 2017). Waldeyer's ring includes the following four structures: (1) The nasopharyngeal tonsil, located at the midline in the roof and posterior wall of the nasopharynx (Fossum et al., 2017); (2) The tubal tonsils (also known as Gerlach tonsils), located on either lateral nasopharyngeal wall immediately posterior to the Eustachian tube orifice and in close association with the torus tubarius (Fossum et al., 2017); (3) The palatine tonsils, located along each lateral oropharyngeal wall between the anterior and posterior tonsillar pillars (Fossum et al., 2017); (4) The lingual tonsils, located along the base of tongue and contiguous with the palatine tonsils at the glossotonsillar sulcus (Fossum et al., 2017). The palatine tonsils are two large, conspicuous almond-shaped mass of the lymphoid tissue forming the lower lateral aspect of the ring and localized in a triangular tonsillar fossa along the anterolateral border of the oropharynx on each side. The dimensions of the tonsils are about 10–15 mm in width and 20–25

mm in length and thickness 1.2cm amd average weight 1.5g in adults, but increase in children. The palatoglossal (anterior pillar) and palatopharyngeal (posterior pillar) mucosal folds diverge from the soft palate to form the boundaries of the tonsillar fossa, which lodges the palatine tonsils. These mucosal arches consist of the palatoglossal muscle (PGm) anteriorly and the PPm (palatopharyngeus muscle) posteriorly. The palatine tonsil has two poles, upper and lower; two borders, anterior and posterior; two surfaces, medial and lateral; three mucosal folds, plica semilunaris, plica triangularis, and plica retrotonsillaris; and two depressions, supratonsillar and anterior tonsillar fossa.

Poles

Superiorly, the tonsil is free and expands into the soft palate where both arches Inferiorly, the suspensory ligament, a band of fibrous tissue, connects the lower join pole with the posterior one third of the tongue. Most of carcinomas develop in the tonsillolingual sulcus which separates the tonsil from tongue anteroinferiorly.

Borders

The tonsillar fossa or sinus is a triangular space between the anterior pillar in front, the posterior pillar behind, and the dorsal surface of the posterior one third of the tongue inferiorly. Because the tonsils are positioned in it, its borders also limit the tonsil (Goyal et al., 2017). The anterior boundary is formed by the platoglossal arch which is composed of the Platoglossal muscle. A cylindrical muscle extends from the palatine aponeurosis to the posterolateral surface of the tongue and becomes continuous with the intrinsic transverse muscles (Goyal et al., 2017). The posterior boundary is formed by the PPa(palatopharngeal arch) including the PPm(palatopharngeus muscle). The lateral fibers of the PPm (palatopharngeus muscle) are composed of the longitudinal and transverse parts. The transverse part inserts into the pharyngeal raphe to join with the contralateral side, whereas the longitudinal part joins with the medial fibers at the posterior border of the soft palate and afterward are merged by the SPm(salpingopharyngeus muscle) (Fukino et al., 2019).

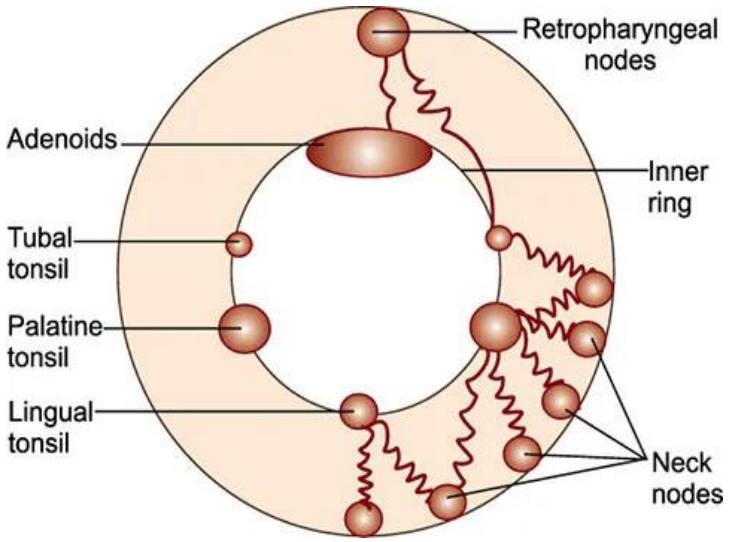

Figure **Error! No text of specified style in document.**. Waldeyer's Inner and Outer Ring

Mucosal Folds

In the 14th–15th week of gestation, the primitive tonsil and tonsillar fossa develop indirectly from the endoderm part of the second pharyngeal arch. At first, the tonsil has two lobes and a plica intratonsillaris (intratonsillar cleft) between them.This plica later usually disappears, but it may

infrequently transform into crypta magna (Isaacson & Parikh, 2008). They are separated from the tonsil by mucosal folds, known as the plica semilunaris and triangularis, which are remnants of the primitive tonsillar fossa. Superiorly the plica semilunaris originates from the upper aspect of the platoglossal arch and extends backward toward the Platopharngeal arch along the upper pole of the tonsil. It encloses a small depression that is known as supratonsillar fossa which separates the tonsil from the uvula. Anteroinferiorly the plica triangularis, an inconstant mucosal fold, arises from the Platoglossal arch and covers the anteroinferior part of the tonsil. It encloses a smaller fossa that is known as anterior tonsillar fossa, which is then obscured by its walls and forms the imbedded portion of the tonsil (Goyal et al., 2017). Also, the plica infratonsillaris or retrotonsillaris may extend to the palatopharngeal arch at the posteroinferior part of the tonsil.

Surfaces

Medial surface is the free mucosal part of the tonsil that faces the oropharynx contains bulging lymphoid projects. It is lined by stratified squamous nonkeratinized epithelium which contains polygonal superficial cells with microridges and numerous tubule-like long invaginations or orifices leading into tonsillar crypts. There are about 10–30 branching and anastomosing crypts, small pores, ranging in size between 5 and 25μm. They increase the surface area of the tonsil up to 300 cm2 except the anterior part for interactions between antigens and the nodular lymphoid tissue. The largest and deepest crypt is called crypta magna or intratonsillar cleft which is localized near the upper part of the tonsil (Goyal et al., 2017). Dendritic cells play a role in the uptake and transport of antigens to extrafollicular T cell and B cell follicles (Sakamoto, 2015).

The tonsillar lymphoid follicles consist of the lymphoid (germinal centers) and non-lymphoid cells (reticular cells and dendritic cells/macrophages). The germinal center is composed of a central area of proliferating B cells which is surrounded by resting B and T cells. Between these follicles, high endothelial venules allow the entrance of T and B cells from the blood and the release of mature lymphocytes into blood (Noussios et al., 2003). So, the tonsils have efferent lymphatic vessels to connect to lymph nodes, but no afferent vessels unlike a lymph node. Lateral surface is a base of the tonsil that is covered by well-defined fibrous capsule at the lateral wall of the tonsillar fossa, which is composed of five layers from within outward. Tonsillar capsule, a thin false or surgical sheet, covers the tonsillar fossa as an appendage of the pharyngobasilar fascia (Ohtsuka et al., 2002). Loose areolar tissue refers to the peritonsillar space between the tonsillar capsule and the pharyngobasilar fascia and contains the paratonsillar veins. Pharyngobasilar fascia or pharyngeal aponeurosis originates from the pharyngeal tubercle and covers the first layer of the SPCm(superior constrictor muscle) and is limited with the inferior fibers of the muscle. Efferent lymphatic vessels from the tonsil pierce through the buccopharyngeal fascia (Mirapeix et al., 2019; Gun et al., 2016). The lateral wall of tonsillar fossa or tonsillar bed is mostly made up of the superior constrictor muscle and pharyngobasilar fascia superiorly, the stylophargeal muscle posteriorly, and the stylohyoid ligament, middle pharyngeal constrictor (MPCm), the Glossopharyngeal nerve (GPn), and styloglossus (StGm) muscles anteroinferiorly.

Frequently, there is a space of 1–3 cm between the superior constrictor muscle and middle constrictor muscle. The glossopharngeal nerve between the stylohyoid ligament and Styloglossus muscle curve forward and medially and pass through this space at the level of the lower pole of the palatine tonsil. At the junction of pharyngeal constrictor muscles beneath the tonsil, the glossopharngeal nerve gives tonsillar branch and afterward, extends into the base of tongue between the Styloglossus muscle and the stylohyoid ligament posteroinferiorly. The buccopharyngeal fascia covers the lateral aspect of the superior constrictor muscle medially and the medial pterygoid muscle anterolaterally. The layers of the lateral pharyngeal wall at the level of tonsillar fossa(tonsillar bed), the parapharyngeal space compartments, and the structures

between external and internal carotid arteries: SPm(salpingopharyngeus muscle); SPCm(superior pharyngeal constrictor muscle); PPm(palatopharyngeus muscle); PGm(palatoglossal muscle); StPm(stylopharyngeus muscle); StHm(stylohyoid muscle); StGm (styloglossus muscle); MPm(medial pterygoid muscle); GPn (glossopharyngeal nerve); PPS(parapharyngeal space); ICA (internal carotid artery); ECA(external carotid artery); X (vagus nerve); XI(accessory nerve) ;XII(hypoglossal nerve) . This series of developmental steps for the palatine tonsils arises from the 2nd pharyngeal pouch (Mirapeix et al., 2019).

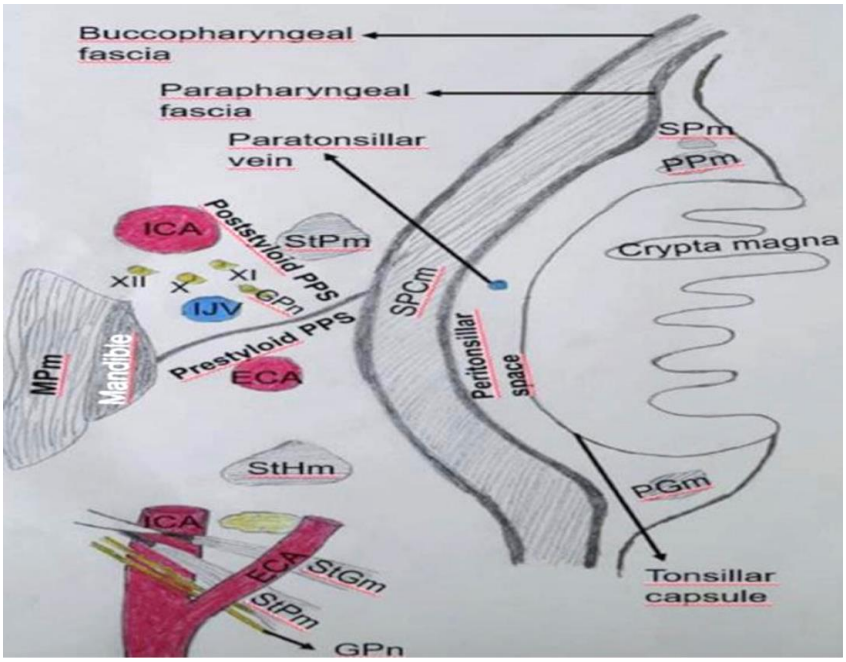

Figure 2. Lateral Wall of Tonsil

Blood Supply of Tonsils

The blood supply of the palatine tonsils derives from vasculature that branches off several major vessels, all are primarily tributaries of the external carotid artery. The dorsal lingual artery, ascending palatine artery, the tonsillar branch of the facial artery, ascending pharyngeal artery, and descending palatine artery all provide oxygen and other nutrients to the palatine tonsils (Wang et al., 2014; Zając et al., 2019). The vascular supply of the tonsil: PPm, palatopharyngeus muscle; PGm, palatoglossal muscle; SPCm, superior pharyngeal constrictor muscle.

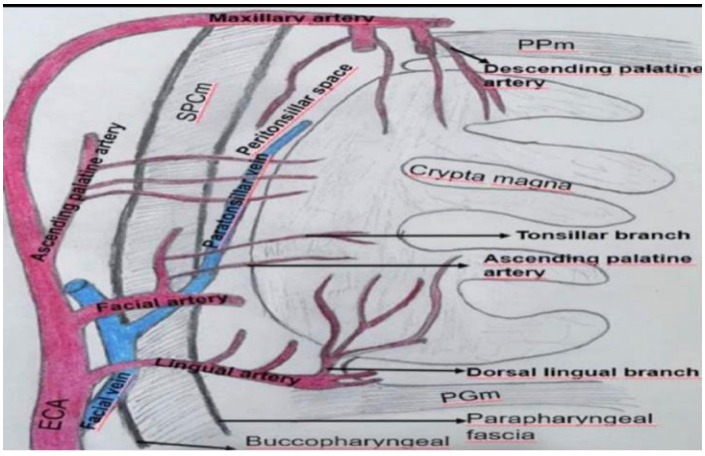

Figure 3. Blood Supply of Tonsils

Venous Drainage of The Palatine Tonsils

The veins of the tonsil and tonsillar fossa drain into the paratonsillar vein and then into the pharyngeal venous plexus. This plexus drains through the facial vein into the internal jugular vein (Brodsky, 2001).

Nerve supply

The innervation of the palatine tonsils is provided by the lesser palatine nerve which arises from the maxillary division of the trigeminal nerve and the tonsillar branches of the glossopharyngeal nerve (Brodsky, 2001).

Lymphatics

The palatine tonsils drain to the jugulodigastric node, a node of the deep cervical lymph nodes, located inferior to the angle of the mandible (Brodsky, 2001).

Functiononal Role of Tonsils Within the Immune System

The tonsils are composed of lymphoid tissue with germinal centres located immediately submucosally. Both T- and B-lymphocytes are present though B-lymphocytes predominate.Tonsil serves both the cell-mediated and humoral immune function.The tonsils have no afferent lymphatics. The B-cells have the capability to synthesize specific antibodies. Contact with IgG and IgA plasma cells are produced allergens in the upper respiratory tract therefore enhances local immunity and also contributes to the development of systemic immunity. There is no evidence to suggest that tonsillectomy results in impaired immunity, presumably as a result of the extensive ‘back-up’ in the immune system.

Microbiology of Palatine Tonsils

The most commonly identified organism from the surface of a diseased tonsil is the group A beta-haemolytic streptococcus (GABHS) (Brook & Gober, 2006). Other organisms found on the surface include Haemophilus influenzae, Staphylococcus aureus, alpha-haemolytic streptococci, Branhamella In recurrent tonsillitis the samples grew a spp, Mycoplasma, Chlamydia, anaerobes and respiratory viruses (Brook & Gober, 2006). Range of pathogens but the predominant organisms were Haemophilus influenzae and S. aureus including methicillin- resistant Staphylococcus aureus (MRSA), mixed flora being quite common.

Indications of Tonsillectomy

Recurrent tonsillitis according to paradise criteria (≥7 episodes in 1 yr or 5 episodes / yr for 2 yrs or 3 episodes / yr for 3 yrs). Obstructive sleep apnea. Suspusion of malignancy. Tonsillitis in patient with febrile convulsion. Peritonsillar abscess. Chronic tonsillitis that is unresponsive to medical therapy and is associated with halitosis, persistent sore throat. Streptococal carrier state unresponsive to medical therapy. Mononucleosis with severly obstructing tonsil unresponsive to medical therapy. Recurrent acute tonsillitis associated with other condition: valvular heart disease.

Tonsillectomy Techniques

Cold Steel Tonsillectomy

The dissection technique is the most common method of cold steel tonsillectomy. In this technique, the tonsilis pulled medially and the mucosa overlying the tonsil capsule is incised. The dissection continues in the plane of loose areolar tissue between the tonsil tissue and the pharyngeal muscles using a dissector, and the tonsil is excised completely. The bleeding vessels are dealt with using diathermy or ligatures as required.

Diathermy Tonsillectomy

Bipolar dissection tonsillectomy is an alternative method to traditional cold steel tonsillectomy. In a Cochrane review of dissection versus diathermy, it was demonstrated that diathermy reduced intra-operative bleeding but increased pain in the diathermy group with no difference in secondary haemorrhage rate. Postoperative bleeding was more frequent with diathermy than with cold steel alone, and particularly worse with monopolar diathermy. Monopolar dissection is known to be associated with more post- operative pain than other techniques and has little to recommend it.

Coblation Tonsillectomy

This technique uses a specially designed probe which both coagulates (50-80 celise) and cuts the tissues. Postoperative bleeding rates were unacceptably high. It has been suggested that post-operative pain is less than conventional dissection but some studies have cast doubt on this and shown that morbidity was less with cold steel dissection.

Aser Tonsillectomy

Laser tonsillectomy emerged as a new procedure that National Institute for Health and Care Excellence published its position in 2006 on its application to UK practice.

Harmonic

History and Principles of Harmonic

The harmonic scalpel is a new surgical tool in which an ultrasonic dissector coagulator simultaneously cuts through tissues and seals blood vessels. Tissues are cut by the instrument's sharp blade, which vibrates at an ultrasonic frequency of 55,500Hz (i.e. 55,000 cycles per second), and haemostasis is achieved by the vibration of the blade causing superficial denaturation and coagulation of the proteins by the production of low temperature (55 ºC to 100 ºC) heat. As a result, the harmonic scalpel functions at far lower temperatures than those produced by either electrosurgery or lasers, which both cut and coagulate only when the temperature has increased to the point where gas pressure has exploded the cells (typically between 150 ºC and 400 ºC). The harmonic scalpel therefore appears to offer the possible advantages of superficial tissue injury combined with good haemostasis of small vessels.

Tonsillectomy Morbidity

Pain

Significant morbidity is associated with tonsillectomy. Post-tonsillectomy sore throat is normal for at least 1 week and on an average return to school or work or diet regularly can take 1–2 weeks.

Peri-operative Complications

If the mouth is opened too widely during the tonsillectomy operation, the patient may experience temporomandibular joint dysfunction. Dissection beyond pharyngeal musculature can lead to injury to the glossopharyngeal nerve and rarely the carotid sheath. Non-traumatic atlantoaxial subluxation (Grisel syndrome) can occur secondary to any inflammatory process in the neck.

Bleeding

Bleeding after tonsillectomy can be primary (within 24 hours after the operation) or secondary (after 24 hours until 2 weeks). The most likely explanation for secondary bleeding is infection by Streptococcus in the granulating tonsil bed.

Infection

The first symptoms of post-tonsillectomy infection are fever and halitosis, mostly between day3-5.and is more in patients with delayed oral intake.

Bleeding After Tonsillectomy

Background

Bleeding after tonsillectomy is the most significant complication of this surgery and can be life-threatening if not managed properly. Post-tonsillectomy bleeding is classified as either primary (within the first 24 hours post-op) or secondary (occurring after 24 hours, typically 5–10 days post-op). Reported overall incidence ranges roughly from 2% to 5% of cases, varying with patient age and surgical technique. For example, adults have higher bleeding rates (around 3–4%) compared to young children (~1–2%). Although mortality is rare (approximately 1 in 20,000 cases), any post-tonsillectomy bleed warrants prompt attention due to the risks of significant bleeding and airway compromise (Öcal et al., 2025).

Causes

Primary bleeding usually results from intraoperative factors – inadequate surgical hemostasis or inadvertent vessel injury during the tonsillectomy. It often becomes evident within the first few hours after surgery and can be related to technical issues or an undiagnosed bleeding disorder. In contrast, secondary hemorrhage occurs after the immediate postoperative period, most commonly around 5–7 days post-surgery when the fibrin clot over the tonsillar bed sloughs off. This exposes the underlying vasculature and can precipitate bleeding. Secondary bleeds are sometimes preceded by a small "herald bleed" – a minor blood trickle that portends a larger bleeding if left untreated. Risk factors for secondary bleeding include patient age (incidence increases in adolescents and adults) and the indication for tonsillectomy; patients who had surgery for recurrent tonsillitis (chronic infection) have a higher bleeding risk, possibly due to greater vascularity and inflammation.

Prevention

Preventive strategies for post-tonsillectomy bleeding start with meticulous surgical technique and thorough hemostasis. Surgeons must carefully cauterize or ligate blood vessels in the tonsillar fossa during the procedure to prevent primary bleeding. The choice of surgical technique can influence bleeding patterns: for instance, cold dissection (steel) tonsillectomy is associated with a lower rate of secondary bleeding (~3–4%) compared to hot techniques like bipolar electrocautery (up to ~8%), though electrocautery tends to minimize immediate bleeding. Good surgical practice also includes preoperative screening for any bleeding tendencies (e.g. coagulopathies, medications) and optimizing the patient's condition before surgery. Postoperatively, adequate pain control and hydration are encouraged to support healing; patients are advised to avoid irritants, strenuous activity, and sharp foods that might disturb the healing scab. Routine prophylactic antibiotics are not generally recommended for prevention – major ENT(ear, nose, throat) guidelines advise against their routine use in uncomplicated tonsillectomy cases (unless there are signs of infection or fever). While infection of the tonsillar bed is thought to contribute to some secondary bleeds, evidence is inconclusive on whether prophylactic antibiotics reduce bleeding risk. Instead, emphasis is placed on patient education (e.g. about maintaining oral hygiene, recognizing early bleeding signs) and close follow-up during the first two weeks after surgery.

Treatment

Management of post-tonsillectomy bleeding depends on severity and timing, but any significant bleeding should be treated as an emergency. Initial priorities are airway protection and hemodynamic stabilization. The patient should be kept calm and seated upright to reduce

aspiration risk and improve visualization of the pharynx. Suction equipment is used to clear blood and clots from the airway, and preparations made for possible difficult intubation (bleeding can obscure the view and blood in the airway increases aspiration risk). Establishing IV access is important for fluid resuscitation and medication (such as tranexamic acid or sedation if needed), and the patient should be made NPO (nothing by mouth) in anticipation of surgical intervention. Prompt consultation with an otolaryngologist is indicated for all post-tonsillectomy bleeding. Even a seemingly minor bleed merits evaluation, because what starts as slow oozing can quickly become severe (the "herald bleed" concept) (Dhaduk et al., 2021).

For milder bleeding cases, conservative measures can be attempted while the surgical team is mobilized. If a clot is visible in the tonsillar bed and the bleeding is not brisk, it is often best not to disturb the clot – disrupting it may precipitate massive bleeding. Instead, the patient can be instructed to gently gargle ice-cold water or a diluted hydrogen peroxide solution; this may help clear superficial clots and induce vasoconstriction to slow bleeding. Topical anesthetics (e.g. benzocaine) can help with comfort, and vasoconstrictive agents can be applied directly: for example, placing a gauze soaked in lidocaine with epinephrine onto the tonsillar fossa to compress the bleeding site. Another adjunct is tranexamic acid (TXA), an antifibrinolytic; TXA can be applied topically on a gauze or even administered as a nebulized mist inhaled by the patient, to promote clot stability. Some emergency protocols also suggest nebulized epinephrine to reduce bleeding via vasoconstriction. These measures, along with observation, may control bleeding in a fair number of secondary bleeding cases. In fact, clinical data indicate that many secondary bleeds can be managed without returning to the operating room if the hemorrhage is minor and stops with conservative treatment.

Definitive treatment is required for ongoing or heavy bleeding, especially primary bleeding, which tend to be more severe. In such cases, the patient should be urgently taken to the operating theater for surgical hemostasis under general anesthesia. Once anesthetized (with the airway secured via intubation), the surgeon can re-examine the tonsillar fossae, suction away clots, and identify the bleeding source. Hemostasis is achieved by cauterizing or suture-ligating the bleeding vessel in the tonsillar bed. According to a large study of 1,200 patients, about 40% of those who experienced post-tonsillectomy hemorrhage ultimately required a return to the OR for bleeding control (this was more common in primary bleeds), whereas the majority of secondary bleeding were managed conservatively. In rare instances where bleeding cannot be controlled through the mouth, ligation of the external carotid artery may be considered as a last-resort measure to stop the bleeding. Patients who have had a significant bleed (whether managed in the OR or not) should be admitted for observation, as the risk of re-bleeding is highest in the first 24 hours after intervention. Supportive care, including blood transfusion if significant blood loss occurred, may be necessary.

Aim of the Study

To compare the incidence of post-tonsillectomy bleeding between conventional (cold steel) and ultrasonic techniques (harmonic).

METHODS

Study Design and Settings

This comparative interventional study conducted at two hospitals in Iraq Babylon government Al-Hilla Teaching Hospital and Al-Imam Al-Sadiq Hospital over a 12-month period from October 2024 to October 2025.

Ethical Issues

Ethical and scientific approval for the research was obtained from the Scientific Committee at the Department of Otolaryngology, Iraqi board for medical specialization. Written consent was obtained from all patients before starting data collection and after explaining the details of the study and assuring confidentiality.

Study Population

The target population comprised all patients underwent tonsillectomy at either hospital during the study window. A total of 260 patients were included and followed for 2 weeks postoperatively for outcome ascertainment. Patients were divided into two groups: (1) Group 1: 130 patients that were treated with Cold-steel dissection; (2) Group 2: 130 patients that were treated with Harmonic (ultrasonic) dissection.

Inclusion Criteria

The study included patients who met all of the following: (1) Underwent elective tonsillectomy at Al-Hilla Teaching Hospital and Al-Imam Al-Sadiq Hospital; (2) Age range from 3-45 years; (3) Ability to complete postoperative surveillance through 14 days (inpatient chart and outpatient/contact follow-up).

Exclusion Criteria

Patients were excluded if any of the following applied: (1) Concurrent major oropharyngeal procedures (e.g., uvulopalatopharyngoplasty) that could alter bleeding risk or confound outcomes; (2) Bleeding disorders; (3) Patients who required electrocautery after ligation.

Data Collection

Data were recorded prospectively on a structured form. Variables included demographics (age, sex); primary indication (recurrent tonsillitis, obstructive sleep apnea); season at surgery; operative technique; occurrence, timing, and initial management of post-tonsillectomy hemorrhage (PTH). Seasonality was predefined by calendar months: October–March as “cold,” April–September as “hot.”.

Preoperative Considerations

NO Preoperative Antibiotic Prophylaxis. Anashesia: The surgery was conducted under general anesthesia with orotracheal intubation. Position (Ros position). A rolled-up towel under the shoulders is necessary, surgeon sits or stands above the head of the patient. Instruments

Figure 4. 1cold Steel Dissection Set
(Magauren Plate, Draffin Bipods, Boyle Davis Mouth Gag, Doughty Tongue Blade, Dennis Browne Tonsil Holding Forceps Metzenbaum Scissor, Gwynne Evan Tonsillar Dissector, Negus

Second Artery Forceps, Negus Knot Tier and Ligature Pusher, Birkett Straight First Artery Forceps, Non Absorbable Braided Silk).

Figure 5. Surgical Ultrasonic Harmonic Scalpel Device, Harmonic Foot Swich, Harmonic Hand Piece

Operative Techniques

A-cold steel tonsillectomy. Aboyle -Davis mouth gag with a ring blade is gently placed into the mouth with the endotracheal tube securely fixed between the tongue and blade anteriorly and in the midline. The mouth gag placed so that the tongue is in the midline position directly behind it. When the mouth gag is slid into position and tounge blade used with mid line opening for endotracheal tube fixation,tonsillectomy is begun by making an incision in the anterior pillar just medial to the mucosal reflection onto the tonsillar surface. Once the capsule of the superior pole has been identified, the tonsil is retracted Medially. This is often assisted by repositioning the Dennis brown forecep. When the inferior pole of the tonsil has been reached, the tonsil can easily be retracted by negus second artery forceps and removed by scissor and ligated by non-absorbable suture. Packing done after that and wait according bleeding time, Hemostasis may also be achieved with sutures. If no bleeding is evident, the pharynx is suctioned and all clots are removed by electric suction device; the patient is dischared to recovery room for awakening and extubation.

Harmonic Scalpel Tonsillectomy

After that tonsil retracted by denis brown holding forceps medially to allow tension placed. An incision is made by harmonic hand piece along anterior pillar to expose tonsillar capsule. Plade of harmonic hand piece used for dissection and cauterazation after pressing of foot pedal on maximum place. Packing done after that and wait according bleeding time. Haemostasis by minimum swich on foot pedal if theres point of bleeding. If no bleeding is evident, the pharynx is suctioned and all clots are removed by electric suction device; the patient is dischared to recovery room for awakening and extubation.

Postoperative Peroid

In ENT department, Patient maintained on injectabe antibiotics for first 24 hours and encourage patient on start cold drinks after 2-3 hours postoperative.

Follow Up

Routinely beginning at time of recovery from anaesthesia by Measuring vital sign (blood pressure,pulse rate) and pharyngeal examination of tonsillar beds to detect if there is bleeding and deal with it. Encourage the patients to start cold a liquid diet or liquid with progression to a semi sold soft diet in second day and to return to normal diet encouraged in 3rd day. Adult patient started with Amoxil vial 500mg as iv route three times per day for the first 24 hours then patien discharged on Augmentin tab 625mg three times per day for 7 days, in addition to analgesia in form of Paracetamol bottle 1 g twice daily for first 24hours and then Paracetamol tab 500mg TID until become free of pain. School age children not exceeding 40kg give Amoxil injection IV route in dose 25-50mg /kg/day for first 24 hours and then Augmentin tab in dose 30mg /kg in three times per day for 7 days and analgesia in form Paracetamol tab in dose 10-15mg/kg TID until become free of pain. After discharged, follow up was achieved in1st week; and 2nd week postopratively in the out-patient clinic for assessment of secondary bleeding

Complication in Our Study

Primary Bleeding

3 patients underwent cold steel tonsillectomy develop primary bleeding in. the first 24 hour all the case manged surgically one case need ligation of anterior and posterior pillars after failed to stop bleeding by suture ligation and bipolar cautery

Secodary Bleeding

"Secondary" bleeding (i.e. bleeding occurring after the first 24 hours) was 10 case underwent harmonic tonsillectomy 8 of them managed conservatively whenever the patient was hemodynamically stable. This typically included systemic antibiotics (AB), (IV ceftriaxone 50mg/kg in two divided dose) and hydrogen peroxide 3% for inactive bleeding for removal of clot.appropriate analgesia, antifibrinolytic therapy such as tranexamic acid (e.g. *Cyklokapron*), and vitamin K when clinically indicated. Following these measures, the patient remained admitted for at least 48 hours, or until bleeding had ceased and vital signs were stable.and 2 of them managed surgically by suture ligation.

Figure 6. Post Tonsillectomy Bleeding (Secondary Bleeding)

Statistical Analysis

Data analysis was done using Statistical Package for Social Sciences (SPSS) version 27 for Microsoft Windows 11. Results were presented in simple measures of frequency, percentage, mean, range, and standard deviation and illustrated as tables and figures. Associations between categorical variables were tested using the Chi-square test or fisher extract test when the expected frequencies are <5. For numerical variables comparisons of means were made using the independent t-test. A p-value < 0.05 was considered statistically significant.

Questionnaire

Personal history: -

Name ----------

Age ----------

Gender ---------

Season ---------

Phone number:

Indication of surgery

Past medical history

Past surgical history

Surgical technique: - Cold Steel - □ Yes □ No

Harmonic - □ Yes □ No

Hemostasis technique: - suture ligation

Bipolar cautery

Primary Bleeding: - □ Yes □ No

Secondary Bleeding: - □ Yes □ No

management of post tonsillectomy bleeding: - conservative - □ Yes □ No

operative- □ Yes □ No

Day of admission ---------

Readmission: - □ Yes □ No

RESULTS AND DISCUSSION

This study included 260 patients underwent tonsillectomy the study was conducted at two hospitals in Iraq Babylon government Al-Hilla Teaching Hospital and Al-Imam Al-Sadiq Hospital over a 12-month period from October 2024 to October 2025.

Table 1. Baseline demographic profile of patients (N = 260)

Variable	Frequency	Percent
Age (years)		
≤ 9 years	124	47.7
> 9 years	136	52.3
Mean ± SD	11.4 ± 8.1	

Median	9	
Range	3-45	
Sex		
Male	146	56.2
Female	114	43.8

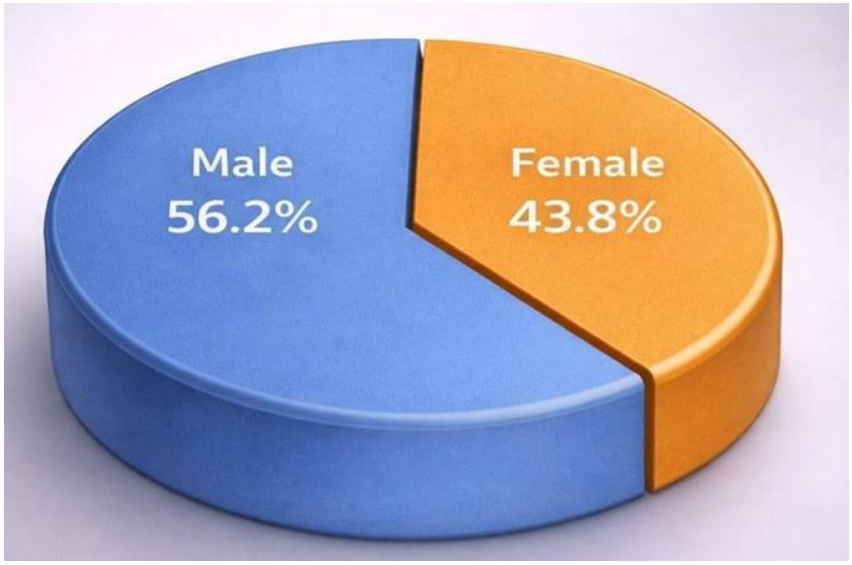

Figure 7. Illustrating Sex Distribution Among Patients Undergoing Tonsillectomy

Their mean age was 11.4 ± 8.1 years and a median age of 9.0 years (range, 3.0–45.0). Males were 146 (56.2%) and females 114 (43.8%) of the cases. As shown in Table 1.

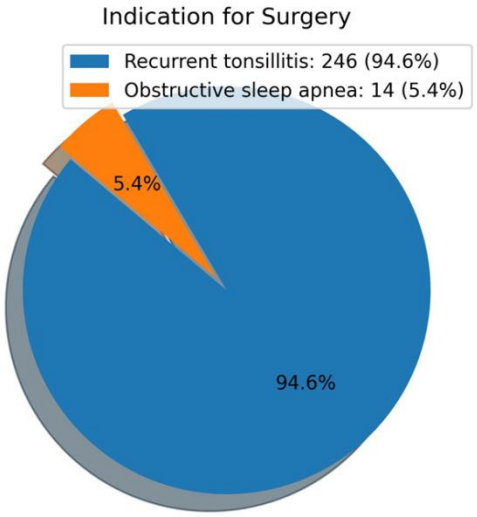

Figure 8. Showing The Indication for Surgery Among the Patients

The predominant surgical indication was recurrent tonsillitis in 246 patients (94.6%), whereas obstructive sleep apnea accounted for 14 cases (5.4%); as shown in table 2.

Table 2. Operative and seasonal characteristics (N = 260)

Variable	Frequency	Percent
indication of surgery		

Recurrent tonsillitis	246	94.6
Obstructive sleep apnea	14	5.4
Primary surgical technique		
Cold steal dissection	130	50.0
Harmonic (ultrasonic)	130	50.0
Season at surgery		
Cold weather	134	51.5
Hot weather	126	48.5

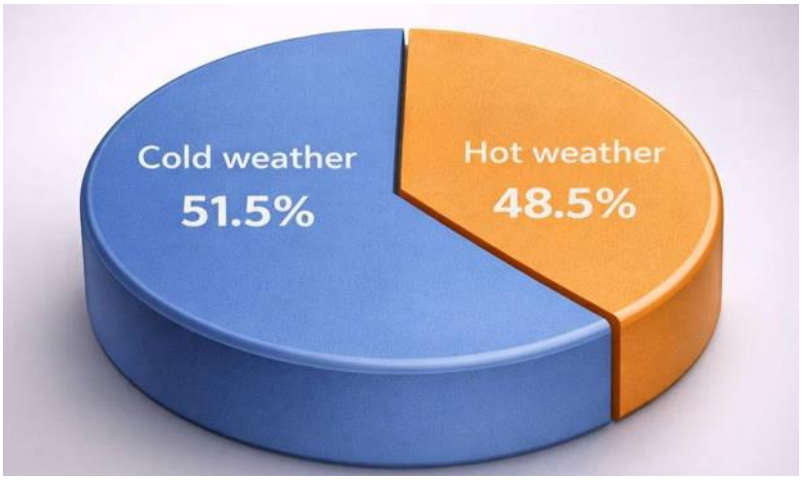

Figure 9. Illustrating The Distribution of Patients According to Season at Surgery

This study showed near-equal seasonality at the time of surgery, cold weather (October-march) 134 (51.5%) and hot weather (April-September) 126 (48.5%). As shown in table 3.2.

Table 3. Association Between Patient Characteristics and Post-Tonsillectomy Bleeding

Characteristic	No bleed n (%)	Bleed n (%)	p-value
Age			
≤ 9 years	121 (97.6%)	3 (2.4 %)	0.068
> 9 years	126 (92.6%)	10 (7.4%)	
Sex			
Male	138 (94.5%)	8 (5.5%)	0.688
Female	109 (95.6%)	5 (4.4%)	
Season at Surgery			
Hot weather	122 (96.8%)	4 (3.2%)	0.19
Cold weather	125 (93.3%)	9 (6.7%)	
Primary Surgical Technique			
Cold steel dissection	127 (97.7%)	3 (2.3%)	0.046
Harmonic (ultrasonic)	120 (92.3%)	10(7.7%)	
Primary Indication			
Recurrent tonsillitis	236 (95.9%)	10 (4.1%)	0.026
Obstructive sleep apnea	11 (78.6 %)	3 (21.4%)	

Bleeding occurred more frequently in patients older than 9 years; however, the association did not reach statistical significance (p = 0.068). There was no statistically significant association between bleeding and sex (p = 0.688) or season at surgery (p = 0.190). A statistically significant association

was observed between post-tonsillectomy bleeding and the primary surgical technique (p = 0.046), with a higher bleeding rate in the harmonic group. In addition, obstructive sleep apnea as an indication for surgery was significantly associated with bleeding (p = 0.026).

Table 4. Timing and Initial Management Among Patients with Post-Tonsillectomy Bleeding (n = 13)

Variable	Frequency	Percent
Time of Bleeding		
primary (< 24 hours)	3	23.1
secondary (≥ 24 hours)	10	76.9
Initial Management of Bleeding		
Operative	5	38.5
Conservative	8	61.5

Post-tonsillectomy bleeding occurred within 24 hours in 3 patients (23.1%) and after 24 hours in 10 patients (76.9%). All primary bleeding episodes required operative intervention, while two secondary bleeding episodes required surgery, totaling 5 patients (38.5%) managed operatively; the remaining 8 patients (61.5%) were managed conservatively.

Table 5. Association Between Patient Characteristics and Timing of Post-Tonsillectomy Bleeding (n = 13)

Characteristic	Primary Bleeding n (%)	Secondary Bleeding n (%)	p-value
Age			
≤ 9 years (n = 3)	1 (33.3%)	2 (66.7%)	1.0
> 9 years (n = 10)	2 (20 %)	8 (80l%)	
Sex			
Male (n = 8)	2 (25 %)	6 (75%)	1.0
Female (n = 5)	1 (20%)	4 (80%)	
Season at Surgery			
Hot weather (n = 4)	1 (25 %)	3 (75%)	1.0
Cold weather (n = 9)	2 (22.2%)	7 (77.8%)	
Primary Surgical Technique			
Cold steel dissection (n = 3)	3 (100.0%)	0 (0.0%)	<0.003
Harmonic (ultrasonic) (n = 10)	0 (0%)	10 (100%)	
Primary Indication			
Recurrent tonsillitis (n = 10)	2 (20.0%)	8 (80.0%)	1.0
Obstructive sleep apnea (n = 3)	1 (33.3%)	2 (66.7%)	

In patients aged ≤9 years, primary bleeding was observed in 1 case (33.3%) and secondary bleeding in 2 cases (66.7%). In patients older than 9 years, primary bleeding occurred in 2 cases (20.0%), while secondary bleeding occurred in 8 cases (80.0%). The association between age and timing of bleeding was not statistically significant (p = 1.000). Primary bleeding occurred in 2 males (25.0%) and 1 female (20.0%), while secondary bleeding occurred in 6 males (75.0%) and 4 females (80.0%). There was no statistically significant association between sex and timing of bleeding (p = 1.000). Regarding season at surgery, primary bleeding occurred in 1 patient (25.0%) operated on during hot weather and in 2 patients (22.2%) operated on during cold weather. Secondary bleeding occurred in 3 patients (75.0%) during hot weather and in 7 patients (77.8%) during cold weather. This difference was not statistically significant (p = 1.000).

A statistically significant association was found between the primary surgical technique and timing of bleeding. Patients who experienced bleeding after cold steel dissection developed primary bleeding (3 cases, 100%), with no cases of secondary bleeding. In contrast, Patients who underwent harmonic tonsillectomy had secondary bleeding (10 cases, 100%). This association was highly statistically significant (p = 0.003). Regarding surgical indication, primary bleeding occurred in 2 patients (20.0%) with recurrent tonsillitis and in 1 patient (33.3%) with obstructive sleep apnea, while secondary bleeding occurred in 8 patients (80.0%) and 2 patients (66.7%), respectively. This difference was not statistically significant (p = 1.000)

Discussion

Tonsillectomy procedure is one of the most common surgical procedures performed by otorhinolaryngologist surgeons. Its Comparative study of two groups patients undergo two Techniqes of tonsillectomy (Cold steel dissection tonsillectomy and Harmonic scalpel tonsillectomy) each group contain 130 patients. There is similar research in Iraq but for different parameters one supervised by consultant dr Ragheed Turkey Miteab (Baghdad Medical City) and another supervised by prof dr safaa sahib naji (Babylon university/ collage of medicine).

Age and Hemorrhage Risk

The present study showed that the bleeding occurred more often in patients older than 9 years, but the difference was not statistically significant. This agree with Inuzuka et al. (2020) that showed increasing age was a risk factor specifically for primary (early) bleeding. Age-related risk may stem from larger tonsillar fossae, stronger pharyngeal musculature, higher blood pressure, smoking exposure, and medication use that can weaken clot stability. The discrepancy between findings likely reflects differences in sample size, age composition (pediatric-leaning vs adult cohorts), and underlying risk profiles.

Sex and Hemorrhage Risk

In this study, sex was not significantly associated with post-tonsillectomy hemorrhage (males 5.5% vs females 4.4%; probability value = 0.68), suggesting no independent effect within the study's age mix and surgical profile. This study was disagree with several adult-focused studies that reported a higher bleeding risk in males, including analyses by Inuzuka et al. (2020) and Ikoma et al. (2014). The reason for these differences include study composition (adult vs paediatric) higher smoking prevalence among adult male,and potential biological and behavirol factors that may destabilize clot integrity.

Season

A higher proportion of bleeding episodes occurred after surgery in the cold months but the difference did not reach significance. Seasonality has been agreed with reported—Öcal et al. (2025) that captured season but did not find it to be an independent predictor. In Iraq, colder months may coincide with higher upper-respiratory infection burden, drier indoor air, and more coughing, any of which could predispose to early clot disruption.

Surgical Technique

Bleeding was higher after harmonic tonsillectomy. This pattern is agree with Alenezi et al. (2025) who reported that cold-steel tonsillectomy had the lowest secondary hemorrhage rate compared with hot technique. Disagree with Samdani et al. (2022) that found no significant difference between techniques. Variation across studies is likely driven by differences in surgeon experience, device parameters, and sample size. Energy techniques create a thermal coagulum that can be disrupted as the eschar separates, whereas cold-steel dissection with suture ligation provides a

mechanical seal. In harmonic technique postoperative pain is greater than with cold steel technique, leading to delayed oral intake of the patient and this predispose to postoperative infection.

Indication for Surgery

The current study reported that the A higher hemorrhage rate was noted among patients with obstructive sleep apnea. This pattern is agree with Bhatti et al. (2025). The small number of OSA cases may have amplified this association.

Timing of Hemorrhage

This study showed that the secondary hemorrhage accounted for the majority of bleeding events. This is agree with Xu et al. (2021) who reported secondary hemorrhage as the predominant pattern. Myssiorek & Alvi (1996) also described secondary hemorrhage as the most common presentation. The association between technique and timing: all cold-steel bleeds were primary, whereas all harmonic bleeds were secondary. This pattern agree with Alenezi et al. (2025) that show the thermal-injury mechanism for late bleeding and further supports paying special attention to post-discharge counselling and early review for patients treated with energy devices

Incidence of Post-Tonsillectomy Hemorrhage

Bleeding rate was 5% in the current study and this pattern agree with Öcal et al. (2025) found about 4–8%, and the UK National Prospective Tonsillectomy Audit reported roughly 3.5%. This difference may be explained by variations in study design and population characteristics. Alenezi et al. (2025) showed a wide range across techniques (0–23%), so the present finding falls within the range obtained in this study.

Study Limitations

Small sample size and limited bleeding events: The relatively small sample size and the limited number of post-tonsillectomy hemorrhage events reduced the statistical power of the study. Consequently, only univariate analysis was performed, and multivariable analysis to identify independent predictors was not feasible. Small number of obstructive sleep apnea cases: Although obstructive sleep apnea showed a statistically significant association with post-tonsillectomy hemorrhage, the number of OSA patients was small, which may have exaggerated the effect size. Therefore, this finding should be interpreted cautiously. Limited generalizability: As the study was conducted in two centers with specific local surgical practices, the findings may not be fully generalizable to other settings or populations. Cost: which is higher in harmonic method which require disposable harmonic hand piece (300 dolar and 2pieces needed on surgon side) and more days of admission (on patient side).

CONCLUSION

This comparative study evaluated the incidence of post-tonsillectomy hemorrhage between harmonic tonsillectomy and conventional cold steel tonsillectomy. The results demonstrated that the harmonic technique was associated with a higher incidence of postoperative bleeding compared to the cold steel method. In contrast, the cold steel technique demonstrated a lower overall rate of postoperative bleeding. Therefore, within the limitations of this study, cold steel tonsillectomy appears to be a safer technique regarding post-tonsillectomy bleeding.

SUGGESTION

Meticulous intraoperative hemostasis remains essential especially during cold-steel dissection to reduce the risk of primary bleeding. Harmonic tonsillectomy was good in certain case such as adult

and obstructive sleep disorders but cost was higher and also the risk of secondary bleeding was higher. Larger, well-powered multicenter studies are recommended to better define risk factors and clarify independent predictors of post-tonsillectomy hemorrhage.

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