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

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ABSTRACT

One of the most common otolaryngological operations is tonsillectomy. The biggest risk after tonsillectomy is bleeding, which can occur early or late and increase 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. Age, sex, indication, surgical method, season, post-tonsillectomy hemorrhage, and first treatment were obtained. Statistical analysis was conducted using suitable tests, with a p-value < 0.05 indicating significance. Post-tonsillectomy bleeding occurred in 13 patients (5%). Secondary bleeding (≥24 hours) was more common than primary bleeding. Statistically significant associations were seen between post-tonsillectomy bleeding and main surgical method and obstructive sleep apnoea as a surgical reason. No significant connection was found between age, sex, and season and 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. The harmonic tonsillectomy approach seems to be related with a larger risk of post-tonsillectomy hemorrhage compared to the cold steel technique, especially in terms of subsequent bleeding.

INTRODUCTION

Tonsillectomy is a common paediatric surgery. Recurrent tonsillitis and obstructive sleep-disordered breathing are the main reasons for tonsillectomy, with or without adenoidectomy (Houborg & Klug, 2022).

Common tonsillectomy can induce bleeding, respiratory difficulty, pain, fever, vertigo, vomiting, and dehydration. Hospital admissions are affected by 3.6% to 16.6% post-tonsillectomy readmissions. A recent study found that haemorrhage was the second biggest cause of procedure readmission after inadequate oral intake. This included 49.4% of readmissions. Post-tonsillectomy haemorrhage in children ranges from 0.2% to 11.9% worldwide, making it a major issue (Alsalamah et al., 2024).

Primary and secondary bleeding are the two primary categories into which post-tonsillectomy hemorrhage is typically classified. Primary bleeding within 24 hours of surgery is often caused by intraoperative haemostasis failure, which can cause small-caliber artery rebleeding. Since it happens after 24 hours, secondary haemorrhage often causes premature eschar sloughing and poor wound healing. Primary and secondary post-tonsillectomy haemorrhage might cause complications and mortality. Since ingested blood can induce aspiration, laryngospasm, and circulatory collapse, primary after tonsillectomy bleeding is considered more dangerous than secondary bleeding (Ikoma et al., 2014; Xu et al., 2021).

History of tonsillectomy

Cornelius Celsus, a Roman physician, described tonsillectomy in the first century AD. He dissected and removed structures with his finger (Hartnick & Ruben, 2000). Duverney first adequately characterised the pharynx in 1761. Wilhelm Von Waldeyer made thorough anatomical and histopathological research in the 19th century. Instruments for the rapid completion of tonsillectomy were introduced by Physick in 1828. Schmidt Sarmento, a surgeon at the Santa Casa of Sao Paulo, performed the first surgery in Brazil during the 1920s (Hartnick & Ruben, 2000). Tonsillectomy is the most common minor surgery globally. New electrosurgery and laser methods are constantly being explored and developed to improve surgical skill and lessen pain and anguish (Hartnick & Ruben, 2000).

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 is circumferential in the oropharynx and nasopharynx.Waldeyer's ring operates at the junction of the respiratory and alimentary tracts, regulating immune responses and filtering foreign antigens (Fossum et al., 2017). Waldeyer's ring has four structures: (1) The nasopharyngeal tonsil is midline in the posterior wall and roof; (2) Gerlach tonsils, posterior to the Eustachian tube entrance and near the torus tubarius, are on either lateral nasopharyngeal wall; (3) Palatine tonsils are located between the anterior and posterior tonsillar pillars on each lateral oropharyngeal wall; (4) The lingual tonsils, located near the glossotonsillar sulcus, are next to the palatine tonsils at the base of the tongue (Masters & Lasrado, 2025). The palatine tonsils are two huge almond-shaped lymphoid masses located on either side of a triangular tonsillar fossa near the anterolateral margin of the oropharynx.They compose the lower lateral part of the ring.The tonsils have an average weight of 1.5g and a width of 10–15 mm, a length of 20–25 mm, and a thickness of 1.2cm in adults. However, they tend to be larger in minors (Regauer, 2006; Brodsky, 2001). The palatoglossal (anterior pillar) and palatopharyngeal (posterior pillar) are mucosal folds that arise from the soft palate and separate to form the tonsillar fossa, a hollow that contains the palatine tonsils. The front aspect of these mucosal arches is made up of the palatoglossal muscle (PGm), and the posterior aspect by the palatopharyngeus muscle (PPm). The palatine tonsil contains superior and inferior poles, anterior and posterior margins, medial and lateral surfaces, three mucosal folds (plica semilunaris, plica triangularis and plica retrotonsillaris) and two depressions (supratonsillar and anterior tonsillar fossa (Masters & Lasrado, 2025; Regauer, 2006).

Poles

The tonsil is free and extends into the soft palate, generating two arches. Suspensory ligament: fibrous band connecting the lower join pole to the posterior part of the tongue. Carcinomas arise

most commonly in the anteroinferior space between the tonsil and the tongue, the tonsillolingual sulcus (Masters & Lasrado, 2025; Regauer, 2006).

Borders

The triangular tonsillar fossa or sinus runs inferiorly from the dorsal surface of the posterior one-third of the tongue to the posterior pillars in front and behind.Because the tonsils are situated within it, the borders of the tonsil also restrict their size (Goyal et al., 2017). The platoglossal muscular arch defines the anterior boundary. The intrinsic transverse muscles are cylindrical from the palatine aponeurosis to the posterolateral tongue (Regauer, 2006; Goyal et al., 2017). The posterior boundary is created by the palatopharyngeal arch, which includes the palatopharyngeus muscle (PPm). Longitudinal and transverse components comprise the lateral fibres of the PPm (palatopharngeus muscle). The longitudinal section joins the medial fibres at the posterior boundary of the soft palate and is merged by the salpingopharyngeus muscle, while the transverse part enters the pharyngeal raphe to join the contralateral side (Goyal et al., 2017; Fukino et al., 2019; Sakamoto, 2015).

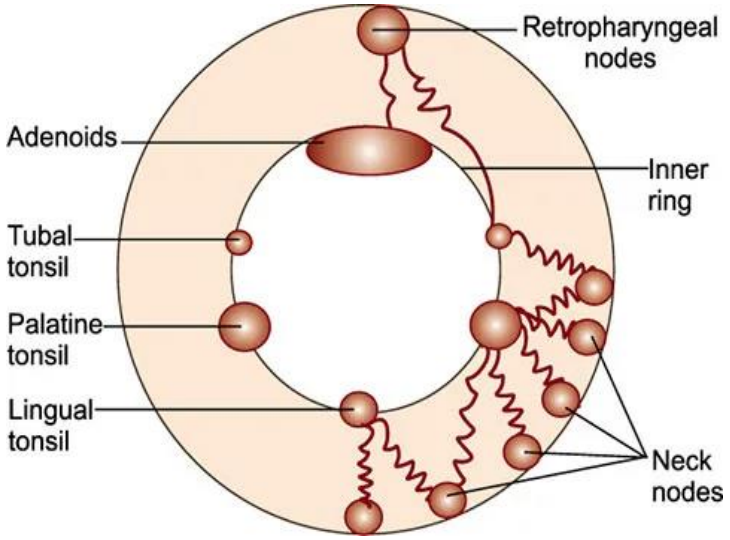

Figure **Error! No text of specified style in document.**. Waldeyer's Inner and Outer Ring

Mucosal Folds

In the 14th–15th week of gestation, the second pharyngeal arch endoderm indirectly generates the primitive tonsil and tonsillar fossa. Initial tonsils have two lobes with a plica intratonsillaris (intratonsillar cleft). This plica diminishes but may sometimes become crypta magna (Isaacson & Parikh, 2008).

They are separated from the tonsil by plica semilunaris and triangularis, remnants of the primordial tonsillar fossa. Superior plica semilunaris arises from the upper platoglossal arch and runs backward to the platopharyngeal arch along the tonsil's upper pole. The supratonsillar fossa separates the tonsil from the uvula. Platoglossal arch mucosal fold plica triangularis covers tonsil anteroinferior. Anteroinferior. Its walls conceal the tonsil-buried anterior tonsillar fossa (Goyal et al., 2017). The plica infratonsillaris or retrotonsillaris may also reach the posteroinferior tonsil palatopharngeal arch. [(12)].

Surfaces

The tonsil's free mucosal medial surface faces the oropharynx and contains bulging lymphoid projections. Polygonal surface cells with microridges and tubule-like long invaginations or orifices

lead to tonsillar crypts in stratified squamous nonkeratinized epithelium. With 10-30 branching and anastomosing crypts, small holes (5-25µm) are present. They increase tonsil surface area to 300 cm2, except for antigen-nodular lymphoid tissue interactions in the front. The intratonsillar fissure near the tonsil's top, crypta magna, is the biggest and deepest (Regauer, 2006; Brodsky, 2001; Goyal et al., 2017). Antigens are transferred to extrafollicular T and B cells via dendritic cells (Brodsky, 2001; Sakamoto, 2015). Tonsil lymphoid follicles include germinal centers and reticular and dendritic cells/macrophages. The germinal core has developing B cells in the middle and resting B and T cells around it. These follicles have high endothelial venules that allow T and B cells to enter and mature lymphocytes to depart the circulation. Tonsils connect to lymph nodes via efferent lymphatic veins but lack afferent arteries (Regauer, 2006; Brodsky, 2001; Noussios et al., 2003). At the lateral wall of the tonsillar fossa, a well-defined fibrous capsule protects the tonsil base. Five outer layers make up the capsule: (1) An extension of the pharyngobasilar fascia that surrounds the tonsillar fossa is the tonsillar capsule, a thin artificial or surgical membrane (Regauer, 2006; Goyal et al., 2017; Ohtsuka et al., 2002); (2) The peritonsillar area between the tonsillar capsule and pharyngobasilar fascia contains the paratonsillar veins. This is "loose areolar tissue (Regauer, 2006; Goyal et al., 2017); (3) Pharyngobasilar fascia, or pharyngeal aponeurosis, covers the first SPCm layer from the tubercle. Muscle's inferior fibres restrict it. Tonsil efferent lymphatics enter buccopharyngeal fascia (Mirapeix et al, 2019; Gun et al., 2016); (4) The lateral wall of the tonsillar fossa or tonsillar bed is primarily composed of the superior constrictor muscle and pharyngobasilar fascia on the superior side, the stylophargeal muscle on the posterior side, and the stylohyoid ligament, middle pharyngeal constrictor (MPCm), Glossopharyngeal nerve (GPn), and styloglossus (StGm) muscles on the anteroinferior side (Ohtsuka et al., 2002; Mirapeix et al., 2019).

Superior and intermediate constrictor muscles are usually 1–3 cm apart. At the inferior pole of the palatine tonsil, the glossopharyngeal nerve bends forward and medially between the stylohyoid ligament and Styloglossus muscle (Sakamoto, 2015). The glossopharyngeal nerve branches into a tonsillar branch at the pharyngeal constrictor muscles beneath the tonsil and subsequently travels posteroinferiorly into the tongue base between the Styloglossus muscle and stylohyoid ligament (Fukino et al., 2019); (5) The buccopharyngeal fascia is situated anterolaterally to the medial pterygoid muscle and medially to the lateral side of the superior constrictor muscle.

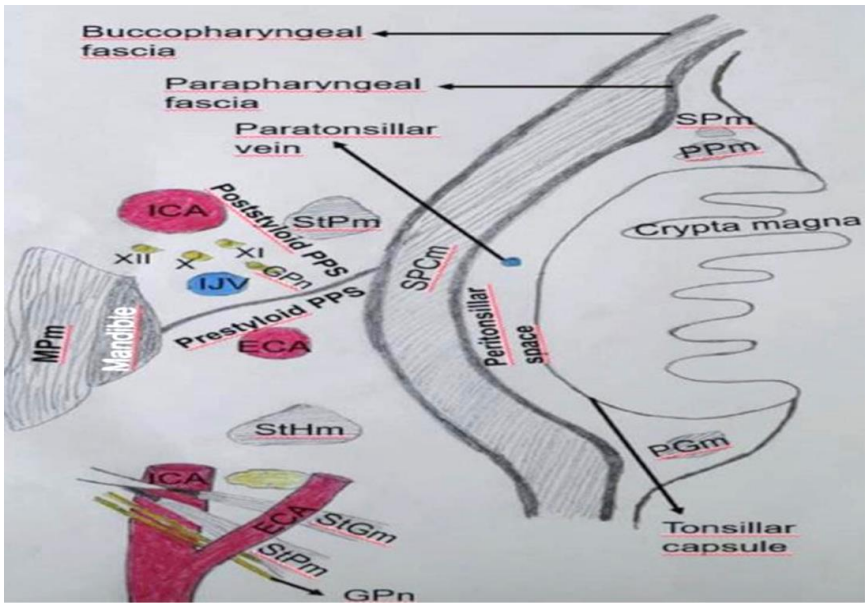

Figure 2. Lateral Wall of Tonsil

Blood Supply of Tonsils

The palatine tonsils are fed by multiple main arteries, mostly branches of the external carotid artery. The dorsal lingual, ascending, tonsillar, ascending pharyngeal, and descending palatine arteries supply oxygen and nutrients to the palatine tonsils (Wang et al., 2014; Zając et al., 2019). Palatopharyngeus muscle (PPm), palatoglossal muscle (PGm), and superior pharyngeal constrictor muscle (SPCm) comprise the tonsil's vascular supply (Xu et al., 2021).

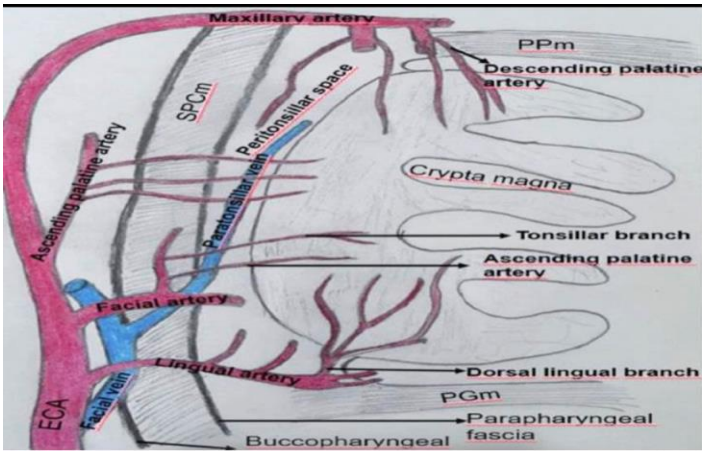

Figure 3. Blood Supply of Tonsils

Venous Drainage of The Palatine Tonsils

The paratonsillar vein is the destination of the veins of the tonsil and tonsillar fossa, which ultimately discharge into the pharyngeal venous plexus. This plexus enters the internal jugular vein via the facial vein (Regauer, 2006; Goyal et al., 2017).

Nerve supply

The lesser palatine nerve, arising from the maxillary trigeminal nerve and the tonsillar glossopharyngeal nerve, innervates the palatine tonsils (Regauer, 2006; Goyal et al., 2017).

Lymphatics

Palatine tonsils flow into the deep cervical lymph node jugulodigastric node, situated below the jaw angle (Regauer, 2006; Goyal et al., 2017).

Functiononal Role of Tonsils Within the Immune System

The germinal centers of the tonsils are situated immediately submucosally and are composed of lymphoid tissue. B-lymphocytes are the predominant type, although both T- and B-lymphocytes are present.Tonsil is involved in both humoral and cell-mediated immune responses.There are no afferent lymphatics in the tonsils. The B-cells are capable of producing specific antibodies. Local immunity is enhanced and systemic immunity is facilitated by the production of antigens in the upper respiratory tract by contact with IgG and IgA plasma cells. The substantial immune system ‘back-up’ after tonsillectomy does not appear to impede immunity.

Microbiology of Palatine Tonsils

The group A beta-haemolytic streptococcus (GABHS) is the most frequently identified organism on the surface of a diseased tonsil (Brook, I., & Gober, 2006). Surface organisms include Haemophilus influenzae, Staphylococcus aureus, and alpha-haemolytic streptococci. Recurrent tonsillitis samples contained Branhamella, Mycoplasma, Chlamydia, anaerobes, and respiratory

viruses (Brook, I., & Gober, 2006). Hemophilus influenzae and S. aureus, including MRSA, were the most common pathogens, along with a mixed flora.

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

Dissection is the most common cold steel tonsillectomy procedure. This procedure involves pulling the tonsilis medially and incising the tonsil capsule mucosa. The tonsil is entirely removed using a dissector in the plane of loose areolar tissue between the tonsil tissue and the pharyngeal muscles. The bleeding vessels are treated with diathermy or ligatures (Shirley et al., 2010).

Diathermy Tonsillectomy

Cold steel tonsillectomy can be replaced with bipolar dissection. Diathermy lowered intraoperative bleeding but increased pain, with no difference in future haemorrhage, according to a Cochrane review. Diathermy caused higher postoperative haemorrhage than cold steel, especially monopolar diathermy. It is commonly acknowledged that monopolar dissection is linked with a larger degree of postoperative pain than other procedures and has little to recommend it (Pinder et al., 2011).

Coblation Tonsillectomy

This approach uses a specially designed tool to coagulate (50-80 degrees Celsius) and dissect tissues. Postoperative haemorrhage was excessive. Some studies challenge whether cold steel dissection reduces post-operative discomfort and show that morbidity is lower (Philpott et al., 2005).

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 device that uses an ultrasonic dissector coagulator that cuts tissues and seals blood arteries at the same time. The sharp blade of the tool vibrates at an ultrasonic frequency of 55,500Hz (i.e. 55,000 cycles per second), and slices tissues. The vibration of the blade , produces low temperature heat (55 ºC to 100 ºC) and surface denaturation and coagulation of the proteins , leading to haemostasis . Therefore, the harmonic scalpel works at far lower temperatures than electrosurgery or lasers, which cut and coagulate only after the temperature has increased to the point at which the cells are blown up by the gas pressure (normally between 150 ºC and 400 ºC). Therefore, it appears that the harmonic scalpel might offer the potential benefits of superficial tissue damage and efficient haemostasis for extremely tiny vessels.

Tonsillectomy Morbidity

Pain

Tonsillectomy causes significant morbidity. A week of painful throat is usual after tonsillectomy, and returning to school, job, or diet might take 1–2 weeks (Hultcrantz et al., 2013).

Peri-operative Complications

Temporomandibular joint dysfunction may result if the patient's mouth is extended excessively during the tonsillectomy procedure. Injury to the glossopharyngeal nerve and, in rare cases, the carotid sheath may result from dissection beyond the pharyngeal musculature. Any inflammatory process in the neck can result in non-traumatic atlantoaxial subluxation (Grisel syndrome) (Shirley et al., 2010).

Bleeding

Primary bleeding that occurs within 24 hours of a tonsillectomy can be distinguished from secondary bleeding that occurs between 24 hours and 2 weeks later. Streptococcus infection in the granulating tonsil bed is the most probable cause of secondary hemorrhage (Shirley et al., 2010).

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 (Shirley et al., 2010).

Bleeding After Tonsillectomy

Background

After tonsillectomy, bleeding is the biggest risk and can be fatal. Post-tonsillectomy bleeding might be primary (within 24 hours) or secondary (5–10 days). 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 (Jiang, 2017).

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 (Jiang, 2017).

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).[2,38]

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. Clinical statistics show that many mild subsequent bleeding may be treated conservatively without surgery.

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. When bleeding cannot be stopped by mouth, the external carotid artery may be

ligated as a final option. Patients with substantial bleeds, whether handled in the OR or not, should be hospitalised for surveillance since re-bleeding is greatest in the first 24 hours. If severe blood loss occurred, supportive treatment may include blood transfusion (Dhaduk et al., 2021).

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

The Iraqi Medical Authority's Department of Otolaryngology Scientific Committee approved the research ethically and scientifically. After being informed of the study and assured of anonymity, all patients gave written consent before data collection began.

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

Prospectively collected data were organised. Demographics (age, sex); primary indication (recurrent tonsillitis, obstructive sleep apnoea); operation season; operating method; post-tonsillectomy haemorrhage (PTH) incidence, timing, and therapy.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

Cold Steel Tonsillectomy

The mouth gag with a ring blade is softly put in the mouth and the endotracheal tube is secured between the tongue and blade anteriorly and midline. The tongue is midway behind the mouth obstruction. After positioning the mouth gag and using the tongue blade with a midline hole for endotracheal tube fixation, an anterior pillar incision is made immediately medial to the mucosal reflection onto the tonsillar surface. After identifying the superior pole capsule, the tonsil retracts medially. The Dennis Brown forecep is often repositioned to help. The tonsil can be withdrawn

using negus second artery forceps, excised with a knife, and ligated with a non-absorbable suture at the inferior pole. Haemostasis can be performed with sutures after packing and waiting for bleeding time. If no bleeding is present, the pharynx is suctioned and any clots removed by electric suction. The patient is awakened and extubated in recovery.

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 postoprativerly 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

The Statistical Package for Social Sciences (SPSS) version 27 for Microsoft Windows 11 was employed to conduct the data analysis. Tables and figures were employed to illustrate the results, which were presented in simple measures of frequency, percentage, mean, range, and standard deviation. The Chi-square test or Fisher extract test was employed to investigate associations between categorical variables when the anticipated frequencies were <5. The independent t-test was employed to compare the means of numerical variables. Statistical significance was defined as a p-value of < 0.05.

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

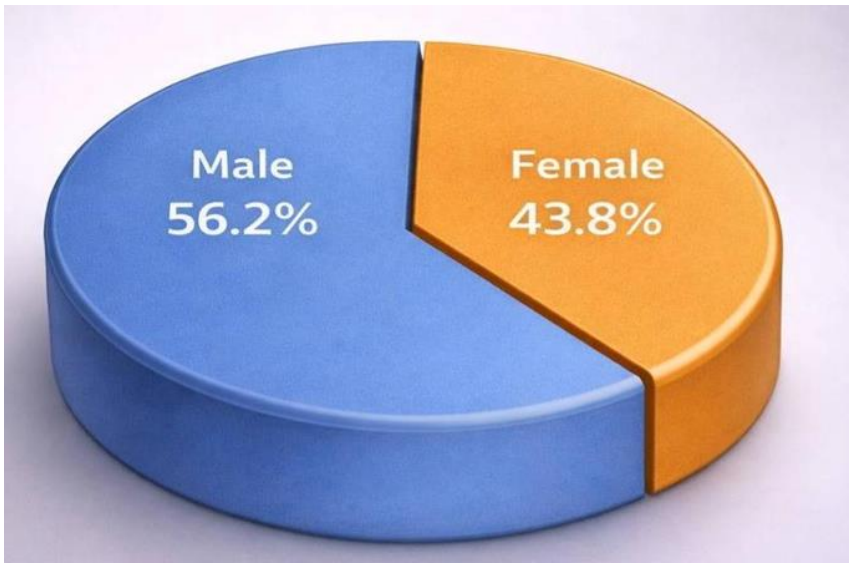

Figure 7. Illustrating Sex Distribution Among Patients Undergoing Tonsillectomy

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.

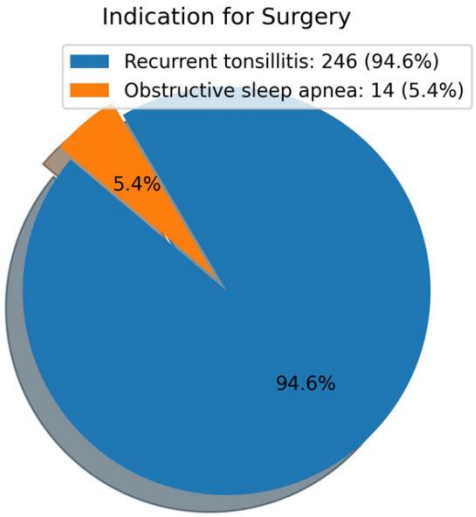

Figure 8. Showing The Indication for Surgery Among the Patients

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

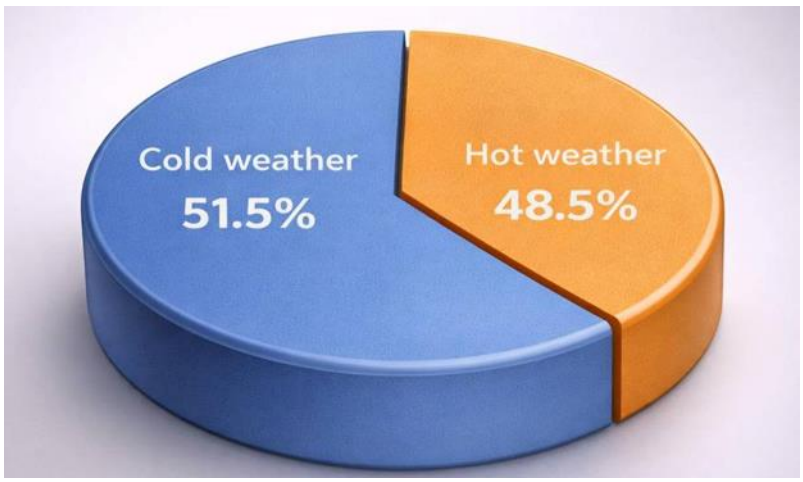

Figure 9. Illustrating The Distribution of Patients According to Season at Surgery

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%)	

Patients older than 9 years had increased bleeding, however the connection was not statistically significant (p = 0.068). Sex and surgical season did not significantly affect bleeding (p = 0.688 and 0.190, respectively). Post-tonsillectomy bleeding was associated with the primary surgical method (p = 0.046), with the harmonic group bleeding more. Obstructive sleep apnoea as a surgical indication was also related 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

Otorhinolaryngologists undertake tonsillectomy one of the most common surgeries. The study compared two tonsillectomy techniques, cold steel dissection and harmonic scalpel, on 130 patients each.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

Sex did not substantially affect post-tonsillectomy haemorrhage (males 5.5% vs females 4.4%; probability value = 0.68), showing no independent influence 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. [42] and Ikoma et al.[3] 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

Harmonic and traditional cold steel tonsillectomy were compared for post-tonsillectomy hemorrhage.The harmonic technique caused more postoperative bleeding than the cold steel treatment. Conversely, cold steel reduced postoperative hemorrhage. Within the constraints of this trial, cold steel tonsillectomy appeared to be safer for post-tonsillectomy hemorrhage.

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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