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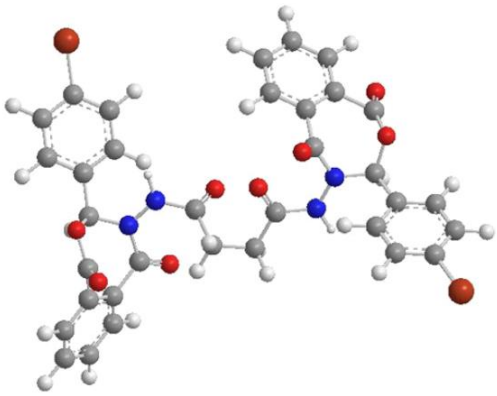

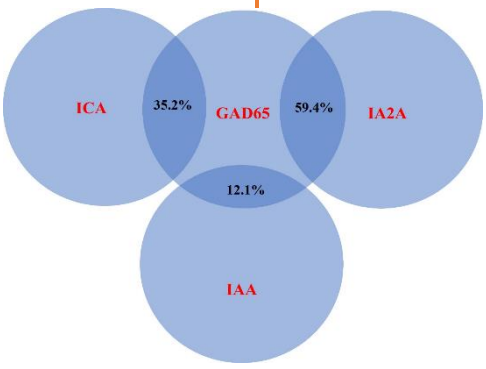

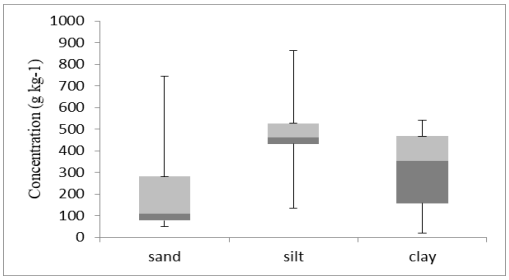

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Wired Snare and Negus Artery Ligation for Securing Lower Pole Tonsillar Removal during Cold Steel Tonsillectomy: A Comparative Study

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Abstract

Background: Tonsillectomy is one of the most commonly practised surgeries in general and otolaryngology. Bleeding tonsillar lower pole, primarily pain and tonsillar remnant are common complications of this operation. **Objectives:** To assess and compare the effectiveness of wired snare removal of the inferior tonsillar pole with negus artery ligaturisation technique regarding bleeding, pain, operative time, and the tonsillar remnant in cold dissection tonsillectomy. **Patients and Methods:** This hospital-based, prospective, comparative study was conducted on 200 patients (400 tonsils) that underwent a tonsillectomy in Sulaimani Teaching Hospital and Shorsh Teaching Hospital from April 2021 to February 2022. On one side, the tonsil's inferior pole was removed by silk using negus artery ligaturisation, while the other lower pole tonsil of the same patient was crushed by wired eves snare. Patients followed up on the 4th, 7th day, and 8th weeks postoperative for bleeding, pain, fever, and tonsillar remnant. **Results:** Most patients were aged 5-10 years (48.5%) and males (56%). The mean±SD of surgical time for wired snaring was significantly (p=0.000) shorter (6.04±0.47 minutes) than that of artery ligation (7.0±1.55 minutes). The tonsillar remnant occurred mainly with ligation, while bleeding more commonly occurred on the snare side (p=0.048). **Conclusions:** Lower tonsillar pole negus ligation removal was associated with less bleeding and pain. However, it is more time-consuming operatively, with more tonsillar remnant occurrence than wired snare removal of the lower pole.

Introduction

Tonsillectomy is one of the most commonly performed otolaryngology surgical procedures that account for approximately 25-40% of, especially in children, conducted by otolaryngologists under general anaesthesia **[1]**.

Generally, the principal indications for tonsillectomy are recurrent and chronic tonsillitis, hypertrophic tonsils, sleep apnea, snoring, difficulties in speaking/eating, peritonsillar abscess or, more rarely, suspicion of tonsillar malignancy **[2]**. Moreover, several complications can occur with a tonsillectomy, such as velopharyngeal insufficiency and dehydration. Thus, thorough research should describe the indications, contraindications, and techniques involved in performing tonsillectomy and highlight the interprofessional team's role in managing these patients before and after surgery **[3]**.

Regarding recurrent tonsillitis, it is recommended to use watchful waiting in patients with <7 episodes in the prior year or <5 attacks annually in the past two years or <3 attacks annually in the past three years. If the frequency of infections exceeds these numbers, tonsillectomy can be recommended as an option for treatment **[3]**.

Various surgical methods for tonsil removal are available to surgeons, including coblation, electrocautery **[4]**, and cold steel technique. The latter is a common method for removing the tonsil using metal instruments, in which the lower pole is secured by either negus ligaturisation or wired snaring **[5]**.

Pain control is one of the most critical factors that must be considered in tonsillectomy. Postoperative pain can continue for up to 2 weeks, leading to decreased oral intake and dehydration, requiring hospital readmission. Opioids are now only given for inadequate pain control after patients have failed first-line therapy **[6]**. Another postoperative complication is bleeding, feared by surgeons and patients alike and must be controlled immediately **[7]**. A higher rate of bleeding was seen with increasing age, white race, and male gender, as well as patients with fluid and electrolyte disorders **[8]**.

Although tonsil surgery is one of the most frequent procedures, only a few population-based regional or country-wide studies are published on the incidence of postoperative bleeding, pain, operative time, and tonsillar remnant. Therefore, this study aimed at comparing the intra-operative factors (blood loss, time taken for surgery), postoperative results (pain, bleeding, dehydration, time taken for complete healing), and other complications like vomiting and hospitalization time between different groups of surgical methods.

Materials and Methods

Design of research

This hospital-based, prospective, comparative study was performed on 200 patients at the Ear, Nose, and Throat (ENT) centre, Sulaimani Teaching Hospital and ENT Department in Shorsh Teaching Hospital, Sulaimaniyah, Iraq, from April 2021 to December 2022. Tonsillectomy was conducted on patients (400 tonsils) with indicated operation on one side by wired snare and on the other side by negus artery ligaturisation techniques.

Inclusion criteria

Patients aged 3-18 years old with a recurrent episode of true acute/chronic tonsillitis were enrolled.

Exclusion criteria

Patients with tonsillar abscess, adenoid enlargement, and unilateral tonsillar enlargement were excluded.

Patient preparation

One day before the operation, the patients were admitted to the hospital for a complete physical examination, careful history and clinical assessment using a well-prepared questionnaire. Patient's data includes age, gender, presented symptoms/signs, duration/type of past medical history, surgical history, and family history of tonsillitis. Then, a complete ENT examination was done, palatine tonsil was assessed for signs and symptoms of tonsillitis, tonsillar hypertrophy, congested and enlarged pillars, and cervical lymphadenopathy (LAP). Next, haematological investigations were evaluated, including complete blood count (CBC), bleeding time, clotting time, blood group, and viral markers. Then, patients were assessed by an anaesthetic doctor for fitness for general anaesthesia.

Study protocol

Patients underwent an operation under general anaesthesia with trans-oral endotracheal intubation. Patients positioned in tonsillectomy (rose) position, supine with the sandbag under the shoulder with head slightly extended over the neck at the atlantooccipital joint and neck flexed over the chest. The technique used to

remove tonsils on both sides was cold steel dissection, including Boyle Davis mouth gag with a tongue depressor introduced and secured over upper teeth and tongue opened with care not to damage the lip, teeth and post-pharyngeal wall. Gag has been confirmed in the optimum position with the drains bipods suspension apparatus. The tonsil was grasped with Denis–Brown tonsil holding forceps and drawn medially. The incision was done in the area of mucosa medial to the free edge of the anterior pillar at the upper pole to the depth of the surgical capsule. Next, tonsils were dissected in the dissection plane at the loose areolar tissue between the pharynx's tablet and the superior constrictor muscle. Then, by blunt dissection beginning in the upper pole, dissection is carried out inferiorly to the junction of the tonsil and base of the tongue, and the final attachment of the tonsil is severed using Eves snare in one side and negus artery with ligation by 1-2 silk ligatures on the other side.

For hemostasis, the tonsillar fossa was packed with gauze immediately following the removal of each tonsil; gauze packs were carefully removed, counted, and weighted before insertion in the fossa and after removal from the tonsillar bed according to the equation of 1.0 gm = 1.0 mL blood. Then, this volume was added to the volume collected in the sucker apparatus container to estimate the loss for each side. All bleeding points were identified and either ligated or diathermies.

On the other hand, from starting the palatoglossal incision to removing the lower pole of the tonsil by both methods, either snaring or ligaturisation, time (duration of surgery) was estimated. Postoperative care was undertaken, and most patients were discharged after a few hours. For the 1st several days (occasionally up to 10 days) following surgery, pain in the throat is to be expected that can be controlled with analgesic (acetaminophen or codeine). Prophylactic antibiotic therapy in the postoperative period for seven days was prescribed. Patients were followed up and assessed directly or by phone for three periods (4th day, 7th day, and 8th week) for pain, fever, bleeding, and tonsillar remnant.

Statistical analysis

Collected data were analyzed using the Specialized Package of Social Science (SPSS, version 24). Descriptive analysis (Mean, Standard deviation, frequency, and percentage of categories were calculated. The chi-square test was used to determine the association between post-tonsillectomy complications and the type of procedure done. Fisher exact test was used when variables were <5. All p-values were based on 2-sided tests, and P<0.05 was considered significant.

3. Results

Regarding the patients' socio-demographics, the highest rate was found in the age group of 5-10 years (48.5%), followed by <5 years (33%), then > ten years (18.5%). Additionally, most patients (56%) were males, and the rest (44%) were females (Table 1).

Table 1: The sociodemographic data of enrolled patients.

Variable		**Frequency**	**%**
Age (Years)	**<5**	66	33.0
	5-10	97	48.5
	>10	37	18.5
Gender	**Male**	112	56.0
	Female	98	44.0
Total		200	100

Around 35.16% of patients had a sore throat, 28.71% had a fever, 19.54% had odynophagia, 13.48 had otalgia, and 3.12% had snoring. Regarding the signs, most patients presented tonsillar hypertrophy

(46.89%), followed by a congested anterior pillar (27.59%), and then LAP (25.73%) (Table 2).

Table 2: The presenting symptoms and signs of the patients.

Variable		Frequency	%
Symptom	Snoring	16	3.12
	Sore throat	180	35.16
	Odynophagia	100	19.54
	Fever	147	28.71
	Otalgia	69	13.48
Total		512	100
Sign	ET	176	46.89
	LAP	97	25.73
	CAP	104	27.59
Total		377	100

CAP: Congested anterior pillar, ET: Enlarged tonsil, LAP: Lymphadenopathy

Regarding the operation time, most patients in the snare method (90.5%) had 6 minutes, while most minor patients (1.5%) had 4 minutes. Whereas, in the ligation technique, most patients (56.5%) had 8 minutes, and most minor patients (5.5%) had 9 minutes (Table 3). The mean±SD of the snare method was significantly (p=0.000) less (6.04±0.47) than that of the ligation method (7.0±1.56).

Table 3: The distribution of the operation time in enrolled patients.

Method		Frequency	%
Snare	4	3	1.5
	5	4	2.0
	6	181	90.5
	7	6	3.0
	8	6	3.0
Ligation	4	24	12.0
	5	24	12.0
	6	15	7.5
	7	13	6.5
	8	113	56.5
	9	11	5.5
Total		200	100

Concerning the association of complications on the 4th postoperative day, there were significant differences between snare and ligation methods in bleeding (p=0.048), while no significant differences (p>0.05) were seen for pain, fever and tonsil remnant (Table 4).

Table 4: The comparison between the rate of complications on the 4th postoperative day.

Variable	Item	Snare		Ligation		P-value
		Frequency	%	Frequency	%	
Bleeding	**Yes**	10	5	3	1.5	0.048*
	No	190	95	197	98.5	
Pain	**Yes**	18	9	9	4.5	0.073
	No	182	91	191	95.5	
Fever	**Yes**	5	2.5	4	2	0.736
	No	195	97.5	196	98	
Tonsil remnant	**Yes**	0	0.0	0	0.0	0.0
	No	200	100	200	100	
	Total	200	100	200	100	

*: Significant difference using the Chi-square test

Whereas the complications on the 7th postoperative day for both techniques showed no significant differences for all variables (p>0.05) (Table 5).

Table 5: The comparison between the rate of complications on the 7th postoperative day.

Variable	Item	Snare		Ligation		P-value
		Frequency	%	Frequency	%	
Bleeding	**Yes**	4	2	1	0.5	>0.05
	No	196	98	199	99.5	
Pain	**Yes**	3	1.5	3	1.5	>0.05
	No	197	98.5	197	98.5	
Fever	**Yes**	1	0.5	1	0.5	>0.05
	No	199	99.5	199	99.5	
Tonsil remnant	**Yes**	0	0.0	0	0.0	>0.05
	No	200	100	200	100	
	Total	200	100	200	100	

Similarly, there were no significant differences between both techniques in terms of complications in the 8th week postoperative for all variables (p>0.05) (Table 6).

Table 6: The comparison between the rate of complications in the 8th week postoperative.

Variable	Item	Snare		Ligation		P-value
		Frequency	%	Frequency	%	
Bleeding	**Yes**	1	0.5	0	0.0	0.317
	No	99	49.5	200	100	
Pain	**Yes**	0	0.0	0	0.0	0.0
	No	200	100	200	100	
Fever	**Yes**	0	0.0	0	0.0	0.0
	No	200	100	200	100	
Tonsil remnant	**Yes**	0	0.0	3	1.5	0.082
	No	200	100	197	98.5	
	Total	200	100	200	100	

Discussion

Tonsillectomy is one of the most commonly performed procedures nowadays, and it is one of the very few surgical procedures that originated in ancient and is still performed today. However, there is a decrease in the number of operations compared to the past; this is related to clinical trials that resulted in a well-defined indication of tonsillectomy. Various surgical techniques are available for the performance of this procedure, and each method has advantages and disadvantages, according to the surgeon's expertise and rare postoperative complications **[1]**.

In this prospective-comparative study, the cold-steel dissection method was used, including snare and ligation techniques applied on the same patient to assess the postoperative outcomes of these methods. Conventional steel-cold dissection is still one of the most commonly used techniques for tonsillectomy worldwide, with satisfactory results **[9]**.

In the current study, patients' ages ranged from 3-16 years old with a mean±SD of 7.0±1.56. This age is the most common age for whom tonsillectomy is mainly indicated. In this regard, Coordes et al., 2016 in Germany reported patients aged 14 to 83 years with a median age of 27 years **[10]**, while Han et al., 2023 in the USA found an age range of 1–18 years with a mean age of 6.06 years in patients experienced tonsillectomy **[11]**. Additionally, Kumar et al., 2022 in India stated a 4-15 age range and 7.50 for the median

age **[9]** and Anwar et al., 2015 in Pakistan found the ages of the patients ranged from 5-40 years with the mean of 15.56±8.24 **[12]**. Similar to our results, Ibrahim et al., 2022 stated an age range of 3 to 19 years with a mean age of 10.22 years **[13]**. On the other hand, most patients in this study were males (56%), which is consistent with that of Han et al., 2023 in the USA (53% males), Kumar et al., 2022 in India (55.88% males), Ibrahim et al., 2022 in Egypt (62% males), and Anwar et al., 2015 in Pakistan (55.5% males) **[9]**. These variations in patients' sociodemographic data might be related to sample size and study duration, in which more extended study periods usually allow more patients can be enrolled.

In the present study, patients who underwent tonsillectomy complained about a sore throat, fever, odynophagia, otalgia, snoring, tonsillar hypertrophy, congested anterior pillar, and LAP. In this respect, Mueller et al., 2015 in Germany stated that the most frequent indications for tonsillectomy were recurrent tonsillitis, tonsillar abscess, and tonsillar hyperplasia **[7]**, while airway obstruction, recurrent infection, and infection/obstruction were reported by Han et al., 2023 as indications for tonsillectomy **[11]**. Additionally, Kumar et al., 2022 said that a history of recurrent episodes of upper respiratory tract infections, mouth breathing, snoring, and difficulty breathing/swallowing drove patients to tonsillectomy **[9]**. These variations might be related to the patient's factors, such as age, gender, comorbidity, immune status, history of diseases, and medication history.

Moreover, we determined that the tonsillectomy operative time by wired snare was significantly ($p=0.000$) shorter than that of artery ligation, mainly because the snare technique is more straightforward, more uncomplicated, needs less time to prepare, and no more instruments are required. In this respect, the operation process was completed in most patients in the snare method (90.5%) in about 6 minutes; however, in the ligation technique, most patients (56.5%) took 8 minutes. These results are inconsistent with that found in India by Verma et al., 2017 who mentioned that the time taken to control perioperative bleeding was higher with cold steel (18-20 minutes) than with others **[5]**. Moreover, Lin et al., 2019 in the USA showed that tonsillectomy took 12-19 minutes using techniques **[4]**. As Ahmed et al., 2000 mentioned, the average operative time was 15.7 minutes with cautery and 26.9 minutes for the dissection method **[14]**. Similarly, Ibrahim et al., 2022 showed bipolar dissection had a highly significant low operative time (12.02±1.27 minutes) than cold steel dissection (22.37±2.12 minutes) ($p<0.001$) **[13]**. These variations refer mainly to a type of operation/technique, the surgeon's experience, and the patient's data.

Consequently, the postoperative complications of tonsillectomy in this study were bleeding, pain, and fever (mainly on the 4^{th} day postoperative, and significantly reduced in consecutive days) with tonsillar remnants (only in 3 patients at the 8^{th} week postoperative in ligation method). Similarly, Kumar et al., 2022 mentioned high pain towards the end of the first postoperative week. However, they considered secondary bleeding a complication indication in patients **[9]**. Postoperative bleeding was also mentioned as a complication in other studies using different techniques, including silk ligation and diathermy coagulation **[12, 15]**, coblation tonsillectomy and cold steel dissection **[16]**, cold dissection and radiofrequency tonsil ablation **[17]**. Generally, these variations refer to surgical technique, surgeon's experience, and patient factors.

In the present study, the tonsillar remnant appeared late because there was no bleeding or pain, which may have happened in the first week after the operation. The higher incidence of secondary bleeding depends on the infection that occurred more commonly in the ligation method than the wired-snare method because silk used in the ligation method acts as a foreign-bodies. The aims of ligation are already for hemostasis to cut the blood supply to the remnant part above the ligation point. Postoperative bleeding in this study mainly referred to improper use of prophylactic antibiotics, poor oral food intake and poor oral hygiene post-operatively that caused tonsillar bed infection that resulted in bleeding.

Conclusions

Wired snare is simple, easy, rapid in use, less instrumental and traumatic, and has less chance for tonsillar remnant with shorter operative time and less anaesthetic consumption time than negus artery ligation. Furthermore, the risk of infection in a wired snare is less than in ligation because, in the ligation method, silk acts as a foreign body. However, the ligation method is more effective in controlling and decreasing the risk of both intra and postoperative bleeding. Both Techniques of cold-steel dissection are advisable surgical way for tonsillectomy as, still the best way for practicing tonsillectomy because it is easy, quick and inexpensive. However, using a wired snare or arterial ligation depends on the surgeon's experience; according to the current study, using a wired snare for children <10 years is more beneficial and safer regarding less anaesthetic time. On the contrary, for patients aged >10 years, the arterial ligaturisation method is better due to less risk of postoperative bleeding.

Conflict of interest

The authors confirm that they are not affiliated with or involved in any organization or entity with financial interests.

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