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RESEARCH ARTICLE
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THE OUTCOMES OF MICROSCOPE ASSISTED TONSILLECTOMY WITH BIPOLAR FORCEPS, MICROSCOPE ASSISTED TONSILLECTOMY WITH THE COBLATION METHOD AND TONSILLECTOMY WITH COLD STEEL INSTRUMENTS USING A HEADLIGHT: A COMPARATIVE RETROSPECTIVE STUDY

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Abstract:
Background: To evaluate the outcome of microscope-assisted tonsillectomy via bipolar cautery, microscope-assisted tonsillectomy via coblation and routine cold steel tonsillectomy via the headlight. The primary objective was to ascertain the intraoperative benefit of using magnification with greater illumination. The secondary objectives were to identify the advantages of different techniques in terms of postoperative pain,hemorrhage, both primary and secondary, incidence of readmissions as well as the generation of biomedical waste.
Methods: The records of all patients who underwent tonsillectomy at our hospital between 2021 and 2024 were reviewed. We classified the patients into two groups according to the surgical technique used. The patients in the three groups fulfilled the same inclusion and exclusion criteria. The protocols for pre- and postoperative treatment were identical. All the surgeries performed in this study were performed by the same surgeon. The tonsils were removed by extracapsular dissection method.
Results: The patients under the microscope with bipolar cautery and coblation-assisted tonsillectomy had better visualization of the tonsillar bed, which translated to better hemostasis, a shorter operative time, minimal injury to pharyngeal muscles and no residual lymphoid tissue in the corners of the tonsillar fossa, especially the tonsillolingual sulcus and upper pole. 95% percent of the patients under the microscope with bipolar cautery assisted tonsillectomy, 94% with coblation assisted tonsillectomy, whereas 91% with head light and cold steel assisted tonsillectomy were pain free after 12 weeks ($p < 0.01$). The average blood loss during microscope-assisted bipolar tonsillectomy and coblation tonsillectomy was 0.5 ml, whereas that during headlight and cold steel tonsillectomy was 15ml ($p < 0.01$). The average surgical time was 14 min under a microscope with bipolar assisted tonsillectomy and 12 min under a microscope with coblation assisted tonsillectomy, whereas in the other groups, it was 35 min ($p < 0.01$).

Conclusion: Bipolar cautery and coblation dissection under microscopic visualization is better than cold steel dissection with headlight in terms of intraoperative visualization, time and hemostasis. However,the pain score was same across all the groups. The amount of biomedical waste generated via the coblation technique and cold steel technique was greater.

Keywords: Microscope, Tonsillectomy,Coblation, Head light, Cold steel instruments

Introduction:

Tonsillectomy is a reliable and effective treatment for recurrent acute tonsillitis (>4 attacks/yr), grade 4 hypertrophy causing obstructive sleep apnea, tonsilloliths, tonsillar cysts, styloid process excision via the tonsillar route, and excisional biopsy of tonsillar masses. Many surgical methods have been described, including cold steel dissection via headlight with or without magnification, coblation-assisted tonsillectomy, laser-assisted tonsillectomy, and monopolar cautery-assisted tonsillectomy.

In a previous comparative study, tonsillectomy with the coblation technique, cold steel method, cryosurgery, guillotine, laser-assisted tonsillectomy, harmonic scalpel-assisted tonsillectomy, monopolar diathermy-assisted tonsillectomy, bipolar diathermy-assisted tonsillectomy, microdebrider-assisted tonsillectomy, etc., were studied. They were centered around pain and blood loss. We performed a comparative retrospective study including 147 patients who were operated on via a microscope with bipolar cauterization and a microscope with coblation assisted by a cold steel technique without magnification with a head light (traditional teaching at medical institutes) and who were subjected to comparative patient selection and an identical postoperative treatment protocol. The three groups of patients differed solely in the modality of the surgical approach. To our knowledge, this type of comparison, which uses the advantage of microscopic magnification with greater illumination, is the largest tonsillectomy study published, with the highest comparability of the groups of patients. The simple randomization technique was used for the allocation of patients in different groups.

Methods:

The medical records of all patients who underwent tonsillectomy between April 2021 and May 2024 were reviewed. Our study included three different surgical methods in which patients were divided and data was compared. These surgical methods included microscopic bipolar cautery-assisted tonsillectomy, microscope-assisted coblation tonsillectomy and head light-assisted tonsillectomy with cold steel instruments(traditional teaching method). Patients with complicated tonsillar disease, such as malignancy, pleomorphic adenoma of the palate involving the tonsils, lymphoma, etc., who did not receive standard surgical and postoperative treatment but instead underwent special surgical procedures were excluded. The microscope was focused at 2.5x magnification at the beginning of surgery with a 250 mm objective lens. However, as the dissection proceeded, we switched to 5X magnification in patients with fibrotic adhesions from adult tonsillectomy.

The data on demographics, operation technique used, length of operation, primary and/or secondary hemorrhage encountered, pain scores on the VAS scale, use of gauze rolls, type of coblation wand used and reasons for readmission were collected. The minimum age of the patients was 5 years, and the maximum age was 73 years in this study. The patients were administered IV antibiotics(preferably ceftriaxone with sulbactam) and IV tranexamic acid 2 h before the operation, which was continued until the 3rd postoperative period. The IV fluids were administered for 12 hrs postoperatively. It was stopped once the patient started taking oral fluids and cold bland diets. However, IV fluids were restarted when patients experienced severe pain and refused to consume oral fluids and food.

In cases of readmission after discharge after the 2nd postoperative day, patients underwent examination for vital signs, routine hematological evaluation, IV antibioticsand IM analgesics (diclofenac or tramadol), hydrogen peroxide gargles with or without betadine, IV pantoprazole, etc.

Results:

Demographics

A total of 147 patients were analyzed among which 77 were females and 70 were males (Fig 1).The patients were divided in the age groups of less than 10, 1In our study, 47patients underwent tonsillectomy via the traditional cold steel instruments with a head light, 51underwent tonsillectomy with a microscope and bipolar forceps, and 49 underwent tonsillectomy with coblation under microscope (Fig 2).

When comparing theoperative time of different surgeries, we found that on an average operative time was 14 minutes in microscopic bipolar cautery-assisted tonsillectomy, 12 minutes microscope-assisted coblation tonsillectomy and, 35 minutes in head light-assisted tonsillectomy with cold steel instruments(traditional teaching method) (Fig 3).

Operative time mentioned above does not include the time required to install the operating microscope. The duration ranged from 5 min to 7 min for most of the operative preparations. The lens used was 250 mm long, and the camera was attached to a beam splitter for live display and recording of the operative video for training purposes.

Postoperative pain was assessed in all the patients who underwent different surgeries for tonsils on 3th, 10th and 30th day using one-way Anova analysis. It was observed that Anova results in different surgery groups on 3rd post operative group were not statistically significant (F-stat 0.0066, P value 0.9934)(Table 1).

According to the conventional criteria, Anova results in different surgery groups on 10th post operative group were not statistically significant (F-stat 0.1878, P value 0.8319)(Table 2).

Also, Anova results in different surgery groups on 30th post operative group were not statistically significant (F-stat 0.0200, P value 0.9802)(Table 3).

Data was collected for age, sex, operative time, hemorrhage (both primary and secondary), VAS[6] pain score, number of sponges used intraoperatively and incidence of readmission from the 3rd postoperative day until the 10th postoperative day (Table 4,5,6). We found that with the cold steel method, the use of sponges and operative time was higher than other two methods. However, the VAS pain scores were almost identical across all age groups. In the case of readmission, all three techniques had almost the same incidence. Readmission was related mainly to pain-associated difficulty swallowing. They were admitted for IV fluids to correct dehydration. IV antibiotics and analgesics were administered depending upon the patient's situation.

One way ANOVA was used to analyze the findings (operative time, primary hemorrage, secondary hemorrage, readmission, number of sponges generated as biomedical waste) (Table 4,5,6). In case of operative time, the test statistic F equals **5.296589**, which is not in the 95% region of acceptance: [0: 4.2565].The difference between the sample averages of some groups is big enough to be statistically significant.

In case of primary hemorrhage, the test statistic F equals **0.157895**, which is in the 95% region of acceptance: [0: 4.2565], and the difference between the sample averages of all groups is not big enough to be statistically significant.

In case of secondary hemorrhage, F equals **0.3**, which is in the 95% region of acceptance: [0: 4.2565] and the difference between the sample averages of all groups is not big enough to be statistically significant.

For use of sponges, the F equals **12.259257**, which is not in the 95% region of acceptance: [0: 4.2565] and the difference between the sample averages of some groups is big enough to be statistically significant.

For readmission, the test statistic F equals **0.6**, which is in the 95% region of acceptance: [0: 4.2565]. The difference between the sample averages of all groups is not big enough to be statistically significant.

Discussion:

The patients in the three groups were compared in terms of age, gender, preoperative diagnosis, and pre- and postoperative treatment. There is a lack of standardization regarding which technique is associated with better intraoperative visualization, hemostasis, and the lowest complication and morbidity rates.

Tonsillectomy is a routinely performed surgery in most hospitals with otolaryngology department. During the postoperative period, the major concern is bleeding and pain. The time required to achieve normal activity and swallowing is a matter of concern. Traditionally, conventional techniques such as cold steel methods with headlight illumination have been used for tonsillectomy; however, the efficacy of newer tonsillectomy techniques, including coblation, harmonic scalpel, and laser-assisted tonsillectomies, has been investigated[1,2,3]. Nevertheless, there is a lack of consensus regarding the use of microscopes or other magnification devices, such as loupes, for proper visualization of beds. Moreover, microscopes provide more illumination of the field than do conventional headlights.

In the present study, the surgical duration was significantly shorter for microscope-assisted and bipolar cautery using tonsillectomy and microscope-assisted coblation tonsillectomy than for cold steel tonsillectomy using head light illumination-assisted tonsillectomy. The level of surgeon experience and familiarity with a particular technique and the equipment used were inversely correlated with surgical duration. In our study, we also observed a significant reduction in time with the technique of using a microscope with bipolar cautery-assisted tonsillectomy, as we previously reported our fourth case. The use of a microscope provided magnification and better illumination[7] of areas in the tonsillo-lingual sulcus, upper pole and lower pole which, in traditional surgical techniques, is a hidden area. This led to regrowth of lymphoid tissue in 1 of our patients via the cold steel dissection method with head light illumination. Post tonsillectomy hemorrhage, both primary and secondary, can present as a potentially life-threatening complication, with a reported incidence of 3.3 to 4.5%[5]. It sometimes subsides with outpatient recommendations; however, some patients require IPD admission and surgical intervention to control bleeding. In our series, significantly less bleeding occurred with microscope-assisted tonsillectomy via bipolar cautery and microscope-assisted coblation tonsillectomy than with the cold steel method without magnification. In addition to the tonsillectomy technique, patient age (pediatric versus adult) and tonsillectomy indication (chronic fibrotic tonsillitis versus chronic parenchymatous hypertrophy) are important factors that affect post tonsillectomy bleeding. Post tonsillectomy pain negatively affects quality of life due to poor oral intake of fluids and food. This is because of the disruption of nerve fibers in the 9th and 10th cranial nerves[4]. Moreover,the operated area was allowed to heal by secondary intention, with persistent exposure to infected oral secretions increasing the healing time. Postoperative pain can lead to dehydration, prolonged recovery, and restriction of normal activities if not properly managed. Nearly 12% of patients with microscope-assisted bipolar cautery underwent tonsillectomy, and 16% of patients with traditional cold steel-assisted tonsillectomy under head light illumination were readmitted during the postoperative period of 3–5 days because pain and difficulty swallowing were administered IV fluids to correct dehydration, intramuscular analgesics (diclofenac in adults and paracetamol in children) and IV antibiotics for 24 hr. Most of the patients were discharged after 24 hrs. Patients with dehydration were more likely to develop severe pain than those who were hydrated. We admitted patients who underwent IPD for 3–5 days with IV fluids and injectible antibiotics. The patients were allowed an oral semisolid bland diet after 12 hrs of IPD management or hemostatic surgery (if required).However, we did not find any extra burden of pain using bipolar cautery in the novel technique reported in some papers.

Another less important parameter in our study was the generation of biomedical waste. In the cold steel dissection method, saline-soaked gauze rolls (1.5 cm) were used to pack the tonsillar bed during and following dissection. However, in the case of microscope-assisted tonsillectomy with bipolar cautery, use of gauze or cotton was rarely needed.

Conclusion:
Tonsillectomy under microscopic visualization via bipolar cautery and coblation is better than cold steel dissection with headlights in terms of intraoperative time and hemostasis. However, generation of biomedical waste was greater in case of coblation method (wand) and cold steel method (gauze and cotton rolls). The VAS scores for pain, hemorrhage (both primary and secondary) and postoperative readmissions were identical across all groups.
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Conflicts of interest: None

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Fig 1. Distribution of patients in the 3 surgery groups on the basis of gender

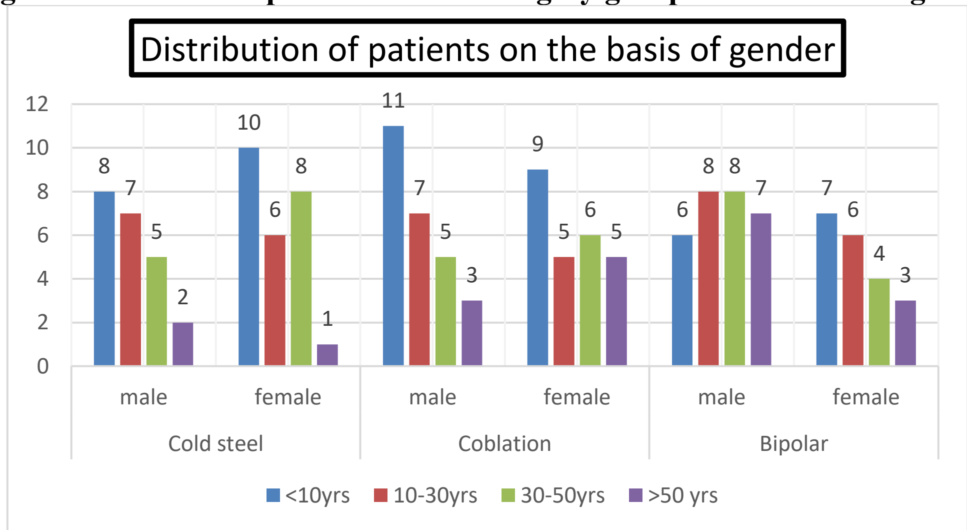

Fig 2. Distribution of patients in different surgery groups

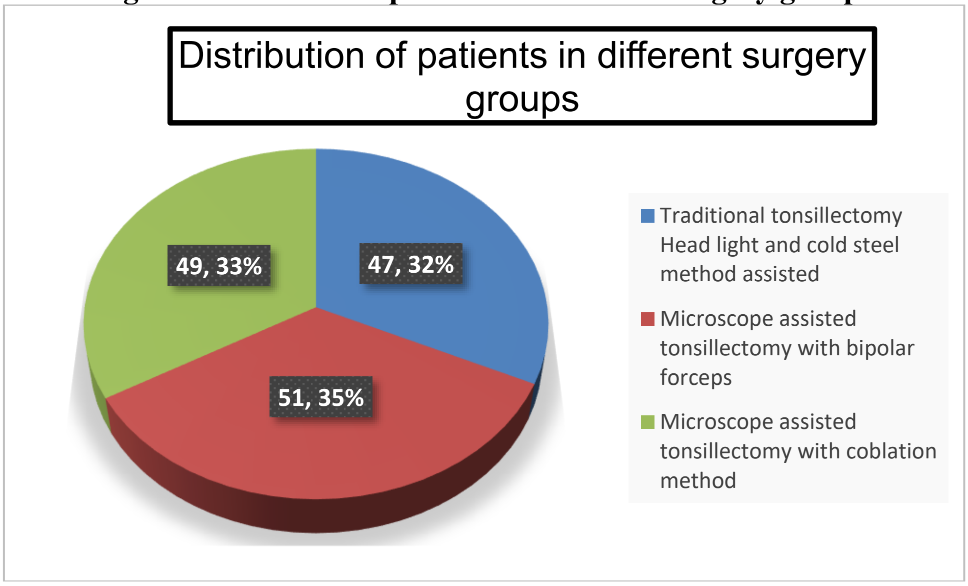

Fig 3. Operative time (in minutes)

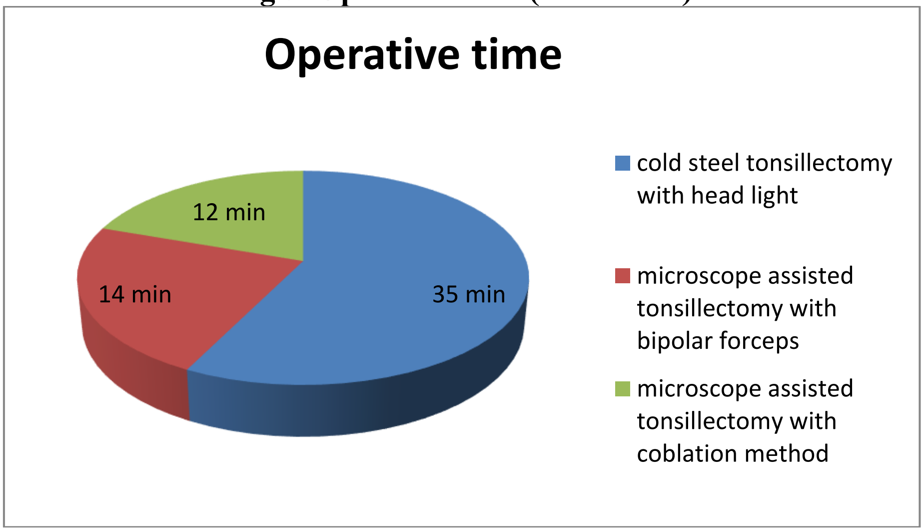

Table 1. Assessment of pain in patients on 3th postoperative day

VAS SCORE	Microscope assisted tonsillectomy with bipolar forceps(MATBF)	Microscope assisted tonsillectomy with coblation(MATCM)	Cold steel tonsillectomy with head light(CSTH)
NONE (0-4 mm)	0	0	0
MILD (5-44 mm)	1	2	1
MODERATE (45-74 mm)	14	11	13
SEVERE (75-100 mm)	32	35	38

Table 2. Assessment of pain in patients on 10th postoperative day

VAS SCORE	Microscope assisted tonsillectomy with bipolar forceps	Microscope assisted tonsillectomy with coblation method	Cold steel tonsillectomy with head light
NONE (0-4 mm)	0	1	2
MILD (5-44 mm)	6	5	8
MODERATE (45-74 mm)	18	22	30
SEVERE (75-100 mm)	17	19	19

Table 3. Assessment of pain in patients on 30th postoperative day

VAS SCORE	Microscope assisted tonsillectomy with bipolar forceps	Microscope assisted tonsillectomy with coblation method	Cold steel tonsillectomy with head light
NONE(0-4 mm)	6	5	6
MILD(5-44 mm)	15	17	14
MODERATE(45-74mm)	22	27	29
SEVERE(75-100 mm)	3	1	3

Table 4. Relationships of various postoperative variables with the age and sex of patients in cold steel tonsillectomy method.

Age	Male	Female	Operative Time (mins)	Primary post- op Hemorrage	Secondary Post-op Hemorrage	Average VAS score (3rd day)	No. of sponges used	Re admission
<10yrs	12	9	15	0	0	55	4	1
10-30yrs	7	5	25	1	1	75	8	1
30-50yrs	6	4	54	1	1	80	14	2
>50yrs	3	2	50	1	0	80	12	0

Table 5. Relationships of various postoperative variables with the age and sex of patients who underwent microscope-assisted tonsillectomy with bipolar forceps

Age	Male	Female	Operative Time(mins)	Primary post-op Hemorrage	Secondary Post-op Hemorrage	Average VAS score (3rd day)	No. of sponges used	Re admission
<10yrs	11	13	12	0	0	50	1	0
10-30yrs	9	4	15	1	0	75	2	1
30-50yrs	7	3	16	1	1	85	2	1
>50 yrs	1	2	16	0	0	80	2	0

TABLE 6. Relationships of various postoperative variables with the age and sex of patients who underwent microscope-assisted tonsillectomy with the coblation method

Age	Male	Female	Operative Time(mins)	Primary postop Hemorrage	Secondary Postop Hemorrage	Average VAS score (3rd day)	No. of sponges used	Re admission
<10yrs	7	12	10	0	0	50	1	0
10-30yrs	10	6	14	0	1	80	1	1
30-50yrs	4	6	12	2	0	75	2	0
>50 yrs	1	1	15	0	0	75	2	0