

## Prospective, Randomized Controlled Study to Evaluate Bipolar Cautery and Diode Laser, Versus Conventional Cold Steel Dissection Tonsillectomy

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### Abstract

**Aim:** To compare the mean operative time, mean blood loss, post-operative pain and complications in tonsillectomy using bipolar cautery and diode laser, versus conventional cold steel dissection tonsillectomy.

**Materials and Methods:** This was a prospective, randomized controlled study of 180 patients in the age range of 3 to 56 years undergoing tonsillectomy or adenotonsillectomy, performed to compare three tonsillectomy techniques: diode laser, bipolar cautery and classical cold dissection (which served as the control) conducted in the Department of ENT, ANMMCH, Gaya, Bihar, India, over a period of 2 years.

**Results:** The operative time, blood loss and pain were significantly lower with tonsillectomy using bipolar cautery and diode laser tonsillectomy than with cold dissection tonsillectomy. Bipolar dissection took the shortest time on an average, whereas blood loss was the least with Diode Laser tonsillectomy. Post-operative pain increased in the Laser group by the 5<sup>th</sup> day.

**Conclusion:** Both bipolar and diode laser tonsillectomy are associated with significantly reduced blood loss, shorter operative times and less post-operative pain compared with cold dissection tonsillectomy. But there was no significant difference seen regarding the postoperative pain when comparing both the surgical methods, by the end of one week.

**Keywords:** bipolar cautery, diode laser tonsillectomy, bipolar dissection

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### Introduction

Tonsillectomy is the most routinely performed surgical operation in the recent years [1]. There have been lots of

controversies about tonsillectomy techniques to provide better conditions with more benefits and less complications. For

more than a century, traditional dissection tonsillectomy has remained the gold standard for tonsil removal.[2] Traditional tonsillectomy leaves the wound open to heal by secondary intention, thus causes pain and bleeding as two major postoperative complications. This is the reason pioneers usually concentrate to decrease these two problems with comparing various techniques.[3] Long periods of wound recoveries, taking up to fifteen days, are not so uncommon. This may bear the risk of bleeding from tonsillar bed.[4, 5]

Numerous techniques have been developed and hundreds of studies performed in an attempt to elucidate an efficacious technique that minimizes morbidity. Despite voluminous research, the current surgical options remain quite varied and there is no clear consensus as to an ideal technique.[6]

Postoperative pain can cause severe limitation in regaining the activities and diet. Considering the mentioned morbidities, attempts have been made to improve the outcome by developing new techniques with less postoperative pain and short recovery period. Available techniques include cold knife dissection, guillotine excision, electrocautery, cryosurgery, the harmonic scalpel, laser tonsillectomy, bipolar diathermy dissection, radiofrequency and coblation methods.[7-10]

Thus, this study aims to compare the mean operative time, mean blood loss and postoperative pain in conventional cold steel dissection tonsillectomy with diode laser tonsillectomy and bipolar cautery techniques.

### Materials & Methods:

This was a prospective, randomized controlled study of 180 patients in the age range of 3 to 56 years undergoing tonsillectomy or adenotonsillectomy,

performed to compare three tonsillectomy techniques: diode laser, bipolar cautery and classical cold dissection (which served as the control) conducted in the Department of ENT, ANMMCH, Gaya, Bihar, India, over a period of 2 years.

These patients underwent tonsillectomy using various surgical instruments like cold knife dissection, bipolar cautery and Diode laser. Patients with chronic tonsillitis and chronic adenotonsillitis, with no known comorbidities (such as Diabetes mellitus, bleeding disorders, or immunocompromised status) were included in the study. Those who underwent tonsillectomy for obstructive sleep apnoea were excluded.

After obtaining consent (from adult patients and from parents of pediatric patients), recruited patients were randomized to one of the three study groups depending upon the surgical dissection instrument like bipolar diathermy, laser and cold dissection.

- Group 1- Patients undergoing bipolar dissection (n=60).
- Group 2- Patients undergoing laser tonsillectomy (n=60).
- Group 3- Patients undergoing cold knife dissection (n=60).

The operative time, blood loss, postoperative pain, fossae after one week and two weeks, and any complication was assessed for each method. Procedures were performed under general anesthesia with a cuffed oral RAE endotracheal tube. The patient was placed in supine position, with the table head at 20° below horizontal and a sand bag under the shoulders. The mouth was opened with a self-retaining Boyle-Davis mouth gag.

Group 1- Bipolar dissection was carried out using the bipolar dissection forceps at a power setting of 15 - 20W for coagulation and cutting modes. The dissection was done

along the tonsillar capsule. Control of bleeding was carried out using bipolar diathermy forceps to coagulate the bleeders.

Group 2- In the diode laser tonsillectomy group, the laser machine was set to 6.5W continuous beams for sub capsular dissection which coagulated and sealed off capillary and minor venous bleeders. However, bipolar diathermy was used for arterial bleeding points, especially near the lower pole. The laser beam was delivered via a 0.6 mm Endostat fiber. Routine precautions for the safety of theatre personnel were followed during the use of the laser.

Group 3 - In the control (cold dissection tonsillectomy) group, tonsils were bluntly dissected in the sub capsular plane between the tonsil and the constrictor muscle. After dissecting down to the lower poles, the tonsils were removed using Eve's tonsillar snare.

Hemostasis was achieved by bipolar diathermy at a setting of 15. Surgical time was measured from the initial incision time to the final hemostasis and removal of mouth gag. Intra operative blood loss was measured by weighing the tonsil swab before and after use, and adding the total so obtained (1gram = 1 ml) to the amount in the suction bottle.

After the procedure, all patients received standard post-operative care and were discharged on the second post-operative day with medication sufficient for seven days

comprising oral antibiotics, analgesic drugs and gargles.

Their pain and discomfort was recorded on a standardized Wong-Baker FACES® pain scale. The scale comprises five drawings of faces ranging from happy and smiling with no pain (score 0) to frowning with tears and with severe pain (score 5). In pediatric cases (age > 6 years), this test was administered to the child and their parents by one of the nursing staff who was blinded to the surgical technique used. We had one child who was 3 years old, who was subjectively assessed by the intensity of cries and the refusal to eat.

Patients were mostly discharged on the second postoperative day and reviewed on the seventh or eighth postoperative day to assess the fossa, and they were asked about the pain scores on each side. Complications if any and the side were noted. A second review was done a week later. The cause of the complication, if any, was determined.

### Results:

Out of 180 patients, 60 patients each were in the bipolar cautery group, diode laser group and in the conventional dissection group.

Among the 180 patients, the minimum age of the patients was 5 years and the maximum was 55 years, 47% patients underwent tonsillectomy and 60% patients underwent adenotonsillectomy and there were 69(82.7%) males and 31(17.2%) females.

**Table 1: Operative time in minutes (n= 180).**

Time	Bipolar group	Laser group	Dissection group
Minimum	21	17	20
Maximum	38	40	60
Mean	11	17	23

Intra Operative time taken:

1. Bipolar Group: bipolar dissection took 11 minutes Laser Group - The

- mean time for laser method was 17 minutes
- Cold knife dissection Group - Mean time taken by cold knife dissection method was 23 minutes.

**Table 2: Intra operative blood loss in ml (n= 180)**

Blood loss	Bipolar group	Laser group	Dissection group
Minimum	20	15	40
Maximum	70	50	120
Mean	20	10	50

Intraoperative blood loss:

- Bipolar Group - The mean blood loss for bipolar dissection was 20 ml
- Laser Group - The mean blood loss for laser method was 10 ml
- Cold knife dissection Group - Mean blood loss in the cold knife dissection method was 50 ml.

**Table 3: The pain scores (VAS) and duration of pain (POD = Post-operative Day)**

Pain / POD	Bipolar group	Laser group	Dissection group
Day 1 - 2	Mild/Mild	Mild	Moderate/Severe
Day 1- 4	Mild/Moderate	Mild/Mild	Mild/Moderate
Day 5 - 6	Mild/Moderate	Mild/Moderate	Mild/Moderate
Day 7 - 8	Mild	Mild	Mild

Post-operative pain:

- Bipolar Group - These patients had mild to moderate pain for the first few days, which became mild/moderate by the fifth day.
- Laser Group - These patients reported significantly less pain on the first two days, however pain then increased, peaking by the 5th to 6th day, and then decreasing.
- Cold knife dissection Group – These patients had moderately severe pain on the first few days which reduced gradually and consistently, till it was mild/moderate by the end of the first week.

All patients, irrespective of the technique, had no pain by the end of two weeks. We did not encounter any complications with any of the techniques.

### Discussion:

Tonsillectomy is one of the most common operations performed in otolaryngology worldwide. [11, 12] Tonsillectomy with steel forceps (as traditional) consumes longer time than coblation tonsillectomy does as a slower dissection.[13]

Alternatively, intraoperative medications have demonstrated a profound effect on patient comfort in the recovery room and probably even in the first days of recovery. Steroid use has been validated by three meta-analyses [14-16]. Despite this, steroid use in studies from table 1 was inconsistent and nonspecific when used, although one study of 102 children was unable to elucidate a dose/ response relationship, suggesting that even low-dose steroids can be effective [17].

No consensus or meta-analysis has indicated an optimal intraoperative analgesic. To name a few, investigators have compared acetaminophen, ketoprofen, meperidine, fentanyl, ketamine, tramadol and morphine in addition to atypical medications like magnesium and clonidine.[18-23] Some of the medications, such as meperidine, are more sedating than others, which may be confused with analgesia. Although arguably effective, the sedation results in delayed discharges [18].

Many different types of lasers were used for tonsillectomy each has its unique physical properties KTP, Nd YAG, CO2 and Diode laser.[24, 25]The cutting action of diode laser is achieved by a red hot cautery effect, which allow delicate cutting and destruction of tissue with very limited lateral damage which seems very useful for tonsillectomy. The diode laser emits laser light at a wavelength of 810nm, which achieves a deep coagulation of up to 1 cm depth of tissue.[26]The use of small fibers in contact mode in diode laser makes the dissection very gentle and is likely to reduce post-operative morbidity. [27]The operative time needed for tonsillectomy by diode laser is significantly reduced in comparison with dissection method in our study, which goes with the results of Saito et al,[28] and Auf et al.[29]

### Conclusion:

Both bipolar and diode laser tonsillectomy are associated with significantly reduced blood loss, shorter operative times and less post-operative pain compared with cold dissection tonsillectomy. But there was no significant difference seen regarding the postoperative pain when comparing both the surgical methods, by the end of one week.

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