

# Comparison of Bipolar Diathermy and Suture Ligation for Haemostasis in Tonsillectomy

MAAMON AMEEN HEZAM<sup>1</sup>, ALI NASIR<sup>2</sup>, ARSHAD ULLAH AFRIDI<sup>3</sup>, FAISAL RAFIQ<sup>4</sup>, DAMISH ARSALAN<sup>5</sup>, ZUBAIR AHMED<sup>6</sup>

<sup>1</sup>ENT Consultant, Gurki Trust Teaching Hospital, Lahore.

<sup>2</sup>Senior Registrar, Fatima Memorial Hospital Lahore.

<sup>3</sup>Assistant Professor, Shalamar Medical and Dental College, Lahore.

<sup>4</sup>Associate Professor, Sharif Medical and Dental College Lahore.

<sup>5</sup>Damish Arsalan, Assistant Professor, Fatima Memorial Hospital Lahore,

<sup>6</sup>Zubair Ahmed, Senior Registrar, Shaikh Zayed Hospital, Lahore.

Correspondence to Dr Nabila Aslam, Email: dr.nabilaaslam@gmail.com, Cell. 0334-4275960

## ABSTRACT

**Aim:** To compare bipolar diathermy and suture ligation for hemostasis in tonsillectomy in terms of the amount of blood loss, number of ligatures applied, average time taken and incidence of postoperative hemorrhage

**Methods:** Randomized controlled trial conducted in the Department of ENT, Shaikh Zayed Hospital, Lahore for a period of one year from July 17, 2017 to July 16, 2018. 66 patients were enrolled. Informed consent and demographic information was taken from all the patients. Patient himself was the control and the trial. One tonsil was treated with bipolar diathermy technique (group A) for haemostasis and other with ligation technique (Group B). Both the tonsil side and the technique were randomized. The outcome in both groups was noted. All the collected data was entered and analyzed on SPSS version 22.

**Results:** The mean age of the patients was 12.39±7.41 years; male to female ratio was 0.8:1. The mean haemostasis time in group A was 10.62±1.76 minutes whereas in group B patients was 14.32±2.81 minutes. The mean blood loss in group A patients was 28.015±8.619 ml whereas in group B patients was 42.82±13.360 ml. The incidence of post-operative hemorrhage was zero for both bipolar diathermy and suture ligation, which shows the safety of both procedures.

**Conclusion:** Bipolar diathermy is safe, effective, easier and faster technique for haemostasis in tonsillectomy than suture ligation.

**Keywords:** Tonsillectomy, Bipolar Diathermy, Suture Ligation

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## INTRODUCTION

Tonsillectomy is a very commonly performed surgery and represents approximately 20% to 40% of all surgeries performed in the field of otolaryngology.<sup>1</sup> Tonsillectomy is surgical removal of palatine tonsils. Tonsil is usually removed with its capsule from its bed (formed by superior constrictor muscle) by dissecting in peritonsillar space.<sup>2</sup>

Many different surgical techniques are used to perform tonsillectomy surgery which include guillotine excision, blunt dissection and snare method, electro-surgery (monopolar cautery, bipolar cautery, laser), ultrasonic removal, cryosurgery, ablation and ligasure tonsillectomy.<sup>3</sup> Choice of the surgical technique depends on surgeon's preference with the aim of reducing the morbidity and complications of the surgery<sup>4,5,6</sup>. Although, tonsillectomy is a relatively simple procedure, it is considered a major surgery because of its known postoperative hemorrhage and anesthesia complications<sup>7,8</sup>.

Hemorrhage in tonsillectomy is classified according to the time of occurrence into primary hemorrhage occurring within 24 hours and secondary hemorrhage occurring after 24 hours from the surgery<sup>9,10</sup>. Primary and secondary hemorrhage rates of 0.6% and 3% respectively and an overall 0.9% of patients returning to operating theatre for hemorrhage control was reported in the National Tonsillectomy Audit; an audit of more than 40000 patients

in the United Kingdom hospitals from 2003 to 2004<sup>9</sup>.

Effective haemostasis is very important part of tonsillectomy and unsuccessful haemostasis can lead to persistent hemorrhage that can lead to shock, increased operating time, aspiration of blood and delay in healing process. Various techniques are used for hemostasis in tonsillectomy varying from gauze pack pressure in the tonsillar fossa, application of adrenaline pack, use of diathermy and application of ligatures to newer technique like Ankaferd blood stopper and ligasure vessel sealing system<sup>6</sup>.

Electro-cautery and suture ligation are the two most commonly used methods for controlling hemorrhage during and after tonsillectomy with variable results. Use of ligatures in tonsillectomy has been a time tested technique of haemostasis, but it has the disadvantages of taking more time to control bleeding, so more blood loss will occur and increase operation and anesthesia time; moreover muscle fibers from tonsillar bed may get gripped with ligatures and cause more pain postoperatively<sup>6,11</sup>. Secondary hemorrhage after suture ligation method is due to loosening of knot and slipping of ligature while straining during coughing or vomiting<sup>12</sup>.

In United Kingdom, the use of diathermy for haemostasis during tonsillectomy remains controversial and 56% of otolaryngologists in U.K don't use diathermy thinking that it can increase patient morbidity and postoperative hemorrhage rates.<sup>13</sup> In bipolar diathermy, cauterization is localized to tissues present between the tips of diathermy forceps and leads to less damage to

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tissues in a controlled and precise fashion resulting in less pain postoperatively.<sup>11</sup>

Many studies addressed tonsillectomy hemostasis with special concern to safety and speed of the technique but have produced conflicting results. In a published prospective study conducted on 180 patients comparing silk ligation with bipolar diathermy it was concluded that less operative time is taken with bipolar diathermy method (15 minutes) as compared to tonsillectomy using silk ligation (30 minutes) for haemostasis. Chances of primary hemorrhage are equal but secondary hemorrhage is less with silk ligation<sup>14</sup>.

In another published prospective comparative study conducted on 250 patients it was concluded that less mean operative time (20 minutes) is taken by bipolar diathermy as compared to silk ligation (30 minutes) and the incidence of primary bleeding was more with silk ligation while the secondary hemorrhage was significantly less with silk ligation<sup>14</sup>.

In tonsillectomy haemostasis, the favorite surgical technique would be the one that results in minimal postoperative pain, minimal bleeding, less operation time and allows the patient to return to their normal daily activities in the shortest period of time. With this aim in mind and in order to clarify the conflict produced by the previous studies, this study (comparison between bipolar diathermy and suture ligation for haemostasis in tonsillectomy); a prospective study is undertaken. As there are physiological, pathological and operative technique factors effecting the result of tonsillectomy and haemostasis<sup>15</sup>, bipolar diathermy and suture ligation was done on the same patient in order to compare more accurately.

The rationale of this study is to determine the effectiveness of bipolar diathermy in decreasing postoperative bleeding (secondary hemorrhage) as its role in postoperative bleeding is still controversial. The local study which have been carried out in Pakistan demonstrate that haemostasis with bipolar diathermy is associated with more incidence of postoperative hemorrhage (secondary hemorrhage) with incidence rate of (13.33%) compared to (4.15%) with suture ligation method<sup>12</sup>.

This is contrary to study done internationally which states that there is no significant difference between the two methods regarding the postoperative hemorrhage<sup>8,11</sup>. Hence, this study would help in counter checking the effectiveness and safety of bipolar diathermy for haemostasis in tonsillectomy and if it is found to be safe and effective it would help reduce surgical and anesthesia time, operation theater time using sutures and will be cost effective.

## MATERIAL & METHODS

**Study Design:** Randomized controlled trial

**Setting:** ENT Department, Shaikh Zayed Hospital, Lahore

**Duration:** One year from July 17, 2017 to July 16, 2018

**Randomization Process:** For two procedures bipolar diathermy and ligation, randomization was done by lottery method. Patient undergoing tonsillectomy was asked to pick the slip for procedure to be conducted for removal of tonsil either on right or on left side. On each slip for 66

patients, the surgical procedure was written as ligation left or ligation right, similarly bipolar left and bipolar right. The slip was taken out by patient him/her self and the same procedure was followed on the side as written on slip and for the other tonsil the other procedure was applied.

The sample size of 132 (66 in each group) was estimated by using 95% confidence level, 90% power of test with an expected mean operative time during surgery of tonsillectomy  $20.00 \pm 15.00$  with bipolar diathermy and  $30.00 \pm 20.00$  with Ligation for haemostasis.

### Inclusion Criteria

- Patients of both gender
- Age: between 4-40 years of age
- Patients with recurrent or chronic tonsillitis
- Enlarged tonsils that cause difficulty breathing, swallowing and obstructive sleep apnea

### Exclusion criteria

- Patients with bleeding diathesis or level of INR more than 1.5
- Patients on anticoagulants
- Patients with acute tonsillitis or co-existing upper/lower respiratory infection
- Patients undergoing adenotonsillectomy.
- Patients with anemia and acute infection
- Hypertensive patient
- Suspicious of malignancy

**Data collection procedure:** 66 patients were enrolled. Informed consent and demographic information was taken from all the patients. Patient himself was the control and the trial. One tonsil was treated with bipolar diathermy technique (group A) and other with ligation technique (Group B). Both the tonsil side and the technique were randomized. The outcome in both groups was noted. All the collected data was entered and analyzed on SPSS version 22.

**Data analysis procedure:** The collected data was analyzed statistically by using SPSS version 22.0. Quantitative variables like mean intra operative blood loss, number of ligatures and time was presented in form of mean  $\pm$  SD. Qualitative variables like gender and post-operative hemorrhage was presented in frequency and percentages. Operative time, amount of blood loss was analyzed by independent sample t-test to see the statistical significance in two groups. P-value less than or equal to 0.05 was considered significant. Chi-square test was used to analyze the frequency and incidence rate of postoperative primary and secondary hemorrhage. A p-value of  $\leq 0.05$  was considered as significant.

## RESULTS

In this study, total 66 patients were enrolled. The mean age of the patients was  $12.39 \pm 7.41$  years with minimum and maximum ages of 5 & 38 years respectively (Table 1)

In this study, 30(45.45%) patients were males whereas 36(54.54%) patients were females. Male to female ratio of the patients was 0.8:1. Fig#1

The mean blood loss of the patients was  $35.42 \pm 13.44$  ml with minimum and maximum values of 18 & 72 ml respectively (Table 2).

The mean haemostasis time of the patients was 12.47±2.98 minutes with minimum and maximum values of 3 & 22 minutes respectively (Table 3).

In our study the left side hemostasis tonsil, hemorrhage tonsil, blood loss tonsil and ligature tonsil was noted in 66(50%) patients respectively whereas the right side hemostasis tonsil, hemorrhage tonsil, blood loss tonsil and ligature tonsil was noted in 66(50%) patients respectively (Table 4).

According to this study the patients with left side hemostasis tonsil in group A were 31(47%) whereas the patients with left side hemostasis tonsil in group B were 35(53.0%). Similarly, the patients with right side hemostasis tonsil in-group A were 35(53%) whereas the patients with right side hemostasis tonsil in-group B were 31(47%). Statistically insignificant difference found between the study groups with hemostasis tonsil side i.e., p-value=0.486 (Table 5).

In this study the mean value of hemostasis time in group A was 10.62±1.76 minutes whereas the mean value of hemostasis time in group B patients was 14.32±2.81 minutes. Statistically significant difference was found between the study groups with hemostasis time i.e., p-value<0.001 (Table 6).

According to this study, the patients with left side blood loss tonsil in group A were 31(47.0%) whereas the patients with left side blood loss tonsil in group B were 35(53.0%). Similarly the patients with right side blood loss tonsil in group A were 35(53.0%) whereas the patients with right side blood loss tonsil in group B were 31(47%). Statistically insignificant difference found between the study groups with blood loss tonsil side i.e. p-value=0.486 (Table 7).

According to this study the mean value of blood loss in group A was 28.015±8.619 ml whereas the mean value of blood loss in group B patients was 42.82±13.360 ml. statistically significant difference found between the study groups with blood loss i.e. p-value<0.001 (Table 8).

The study results showed the patients with left side ligature tonsil in group A were 31(47.0%) whereas the patients with left side ligature tonsil in group B were 35(53.0%). Similarly, the patients with right side ligature tonsil in-group A were 35(53.0%) whereas the patients with right side ligature tonsil in-group B were 31(47%). Statistically insignificant difference found between the study groups with ligature tonsil side i.e. p-value=0.486 (Table 9).

The study results showed that one ligature noted in 1(1.5%) in group A patients whereas one ligature in group B noted in 3(4.5%) patients, two ligature noted in 0(0%) in group A patients whereas two ligature in group B noted in 56(84.8%) patients, three ligature noted in 0(0%) in group A patients whereas three ligature in group B noted in 07(10.6%) patients. Similarly no ligature in group A noted in 65(98.5%) patients whereas no ligature noted in 0(0%) patients in group B. Statistically significant difference found between the number of ligature with study groups i.e. p-value<0.001. Table#10

No primary or secondary hemorrhage was noticed in all patients. So the incidence of postoperative hemorrhage was zero in both the groups.

Table 1: Descriptive statistics of age (years)

Age (years)	N	66
	Mean	12.39
	SD	7.41
	Minimum	5
	Maximum	38

Table 2: Descriptive statistics of blood loss (ml)

Blood loss (ml)	N	66
	Mean	35.42
	SD	13.44
	Minimum	18.00
	Maximum	72.00

Table 3: Descriptive statistics of hemostasis (minutes)

Hemostasis (Minutes)	n	66
	Mean	12.47
	SD	2.98
	Minimum	3.00
	Maximum	22.00

Table 4: Frequency distribution sides of hemostasis tonsils, hemorrhage tonsil, blood loss tonsil and ligature tonsil side

		Frequency	Percent
Hemostasis tonsil side	Left	66	50.0
	Right	66	50.0
Hemorrhage tonsil side	Left	66	50.0
	Right	66	50.0
Blood loss tonsil side	Left	66	50.0
	Right	66	50.0
Ligatures tonsil side	Left	66	50.0
	Right	66	50.0

Fig. 1: Frequency distribution of gender

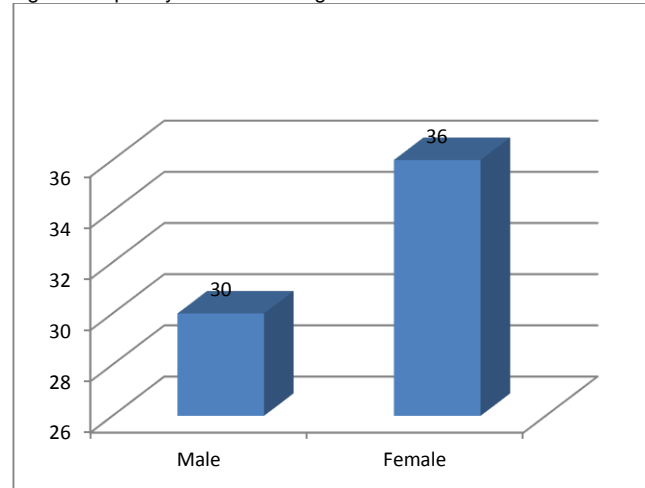


Table 5. Comparison of Hemostasis tonsil side with study groups

		Study Groups		Total
		Group A	Group B	
Hemostasis tonsil side	Left	31 47.0%	35 53.0%	66 50.0%
	Right	35 53.0%	31 47.0%	66 50.0%

Group A= BIPOLAR DIATHERMY  
Chi value=0.485

Group B= LIGATION  
p-value=0.486

Table 6. Comparison of Hemostasis (minutes) with study groups

		Study Groups	
		Group A	Group B
Hemostasis (minutes)	n	66	66
	Mean	10.62	14.32
	SD	1.76	2.81

Group A= BIPOLAR DIATHERMY  
Ind t test=-9.050  
Group B= LIGATION  
p-value<0.001

Table 7: Comparison of blood loss tonsil side with study groups

		Study Groups		Total
		Group A	Group B	
Blood loss tonsil side	Left	31	35	66
		47.0%	53.0%	50.0%
	Right	35	31	66
		53.0%	47.0%	50.0%

Group A= BIPOLAR DIATHERMY,  
Chi value=0.485  
Group B= LIGATION  
p-value=0.486

Table 8. Comparison of blood loss (ml) with study groups

		Study Groups	
		Group A	Group B
Blood loss (ml)	n	66	66
	Mean	28.015	42.82
	SD	8.619	13.360

Group A= BIPOLAR DIATHERMY  
Ind. t test=-7.56  
Group B= LIGATION  
p-value<0.001

Table 9. Comparison of Ligatures tonsil side with study groups

		Study Groups		Total
		Group A	Group B	
Ligatures tonsil side	Left	31	35	66
		47.0%	53.0%	50.0%
	Right	35	31	66
		53.0%	47.0%	50.0%

Group A= BIPOLAR DIATHERMY  
Chi value=0.485  
Group B= LIGATION  
p-value=0.486

Table 10. Comparison of number of ligature with study groups

		Study Groups		Total
		Group A	Group B	
Number of ligatures	One	1	3	4
		1.5%	4.5%	3.0%
	Two	0	56	56
		0.0%	84.8%	42.4%
	Three	0	7	7
	0.0%	10.6%	5.3%	
NO	65	0	65	
	98.5%	0.0%	49.2%	

Group A= BIPOLAR DIATHERMY  
Chi value=129  
Group B= LIGATION  
p-value<0.001

## DISCUSSION

This present randomized control trial was carried out at ENT Department Shaikh Zayed Hospital, Lahore to compare applying suture ligation and bipolar diathermy coagulation for hemostasis in tonsillectomy with variables of time taken to achieve hemostasis and amount of blood loss intraoperatively and numbers of ligatures applied and the incidence of post-operative hemorrhage (primary and secondary).

Although it is one of the most commonly performed surgery in the world, tonsillectomy still raises more questions regarding its technique and complications.

Although tonsillectomy is considered simple and safe, yet surgeons are still keenly aware of its dreaded threat of

complications particularly post-operative hemorrhage that may lead to aspiration and shock.

So many studies have been conducted on tonsillectomy and hemostasis techniques and have created more controversies and more questions than answers.

In this study, statistically insignificant difference was found between the study groups with hemostasis tonsil side, blood loss tonsil side and the ligation tonsil side respectively i.e. p-value=0.486. In our study, statistically significant difference was found between study groups with blood loss. According to this study the mean value of blood loss in-group A was 28.015±8.619 ml whereas the mean value of blood loss in-group B patients was 42.82±13.360 ml i.e. p-value<0.001. Number of of no ligation was also significantly lower in bipolar diathermy group than to ligation group i.e. p-value<0.001. According to this study, the hemostasis time was also significantly shorter in bipolar diathermy group than to ligation group. The mean value of hemostasis time in group A was 10.62±1.76 minutes whereas the mean value of hemostasis time in group B patients was 14.32±2.81 minutes i.e. p-value<0.001. Some of the studies are discussed below showing their results as. Many studies have addressed this issue with particular regard to safety and speed of the technique but have produced conflicting results. In a published prospective study conducted on 180 patients comparing silk ligation with bipolar diathermy it concluded that less operative time is taken with bipolar diathermy method (15 minutes) as compared to tonsillectomy using silk ligation (30 minutes) for hemostasis. Chances of primary hemorrhage are equal but secondary hemorrhage is less with silk ligation<sup>14</sup>.

In another study done by choy et al; they found that bipolar diathermy is easier and take less time to control bleeding and less operation and anesthetic time. It is equally safe and effective as suture ligation and did not cause more post-operative pain.<sup>16</sup> In a study performed by Watson et al no difference was found in severity and frequency of postoperative hemorrhage although the surgical time was significantly reduced with diathermy<sup>17</sup>.

One study by Karan Sharma et al concluded that bipolar diathermy significantly reduced the time of operation and amount of blood loss as compared to suture ligation. Incidence of postoperative hemorrhage was less with bipolar diathermy and the pain postoperatively was comparable with suture ligation<sup>8</sup>.

Reactionary hemorrhage was found to be more in tonsillectomy with ligation (1%) as compared to diathermy (0.3%) in studies conducted by Watson et al<sup>17</sup>, Carmody et al<sup>18</sup> and Malik et al<sup>19</sup>.

This may be due to loosening or slipping of the ligation in the early post-operative period.

In another published prospective comparative study conducted on 250 patients, it was concluded that less mean operative time (20 minutes) is taken by bipolar diathermy as compared to silk ligation (30 minutes) and the incidence of primary bleeding was more with silk ligation while the secondary hemorrhage was significantly less with silk ligation.<sup>12</sup>

The risk of hemorrhage with bipolar diathermy in tonsillectomy dissection and hemostasis was 3% in national prospective tonsillectomy audit<sup>20</sup>.

A study was conducted by Hemant et al on 50 patients where bipolar diathermy dissection was compared with dissection with snare tonsillectomy. They concluded that bipolar diathermy dissection is associated with less blood loss, less operative time, less postoperative pain, early discharge from hospital and reduced morbidity<sup>21</sup>.

Nunez<sup>22</sup> reported a mean blood loss of 15.1 ml for the diathermy group & 33.7 ml for the dissection group.

On the other hand, a study by Khurshid Anwar et al<sup>23</sup> documented that both suture ligation and coagulation diathermy for control of bleeders during the procedure performed by this method are equally effective.

Kujawski et al<sup>24</sup> reported that there was no significant difference between the mean operating time for the diathermy & dissection groups being 36.9 min for diathermy & 35.9 for dissection technique using ligatures.

The local study which have been carried out in Pakistan demonstrate that hemostasis with bipolar diathermy is associated with more incidence of postoperative hemorrhage (secondary hemorrhage) with incidence rate of (13.33%) compared to (4.15%) with silk ligation method.<sup>14</sup> This is contrary to a study done internationally which states that there is no significant difference between the two methods regarding the postoperative hemorrhage<sup>8,13</sup> which have been approved by this study as well .

## CONCLUSION

This study concluded that the bipolar diathermy is safe, effective, easier and faster technique for hemostasis in tonsillectomy than ligation technique in terms of blood loss, hemostasis, operative and anesthetic time and requires less number of ligatures.

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