A COMPARATIVE STUDY OF COLD AND HOT TONSILLECTOMY

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ABSTRACT

BACKGROUND

A wide variety of surgical techniques for tonsillectomy and adenoidectomy are available, and all are essentially safe and effective. Choosing a technique involves a complex decision process conducted with the best interests of our patients in mind. Our study is directed in finding an ideal method of tonsillectomy which is quick to perform, involves minimal blood loss, and has least postoperative pain, and complications.

MATERIALS AND METHODS

This study was a prospective study of 120 patients undergoing tonsillectomy and adenotonsillectomy. Patients were randomly divided into three groups depending upon the surgical dissection instrument used like bipolar (n=40), monopolar (n=40) and laser (n=40), keeping cold knife dissection constant on the left side. The operative time, blood loss, operative field, haemostasis, postoperative pain, fossae after one week and any complication was assessed for each method.

RESULTS

The intraoperative time taken for bipolar method was 12.33 min. which was significantly more than conventional technique which took only 9.36 min. There was significantly less blood loss in the laser technique (6.3 mL) compared to cold knife dissection (19.2 mL) and no significant difference in the postoperative pain and complications among the various methods.

CONCLUSION

Laser tonsillectomy was the procedure which had the least intraoperative blood loss and had no significant difference in the postoperative pain or complications compared to the conventional cold knife dissection. This study was designed to determine the ideal method for tonsillectomy but the residents should be well versed with the conventional cold knife dissection method before learning to use the new tools for tonsillectomy.

KEYWORDS

Cold Knife Dissection, Tonsillectomy, Bipolar, Monopolar, Laser.


BACKGROUND

A wide variety of surgical techniques for tonsillectomy and adenoidectomy are available, and all are essentially safe and effective. Choosing a technique involves a complex decision process conducted with the best interests of our patients in mind. Modern methodologies like use of harmonic scalpel, bipolar scissor dissection, radiofrequency excision with probes, microdebrider tonsillectomy, laser tonsillectomy and the coblation techniques have revolutionised the surgery of tonsillectomy. Ideally tonsillectomy should be fast, bloodless and associated with rapid and uncomplicated recovery. Even though adenotonsillectomy accounts for about 20% of all operations performed by otolaryngologists, there is no consensus on the best method of performing it.1,2

Our study is directed in finding an ideal method of tonsillectomy which is quick to perform, involves minimal blood loss, and has least postoperative pain, morbidity and complications. Since majority of the patients undergoing tonsillectomy are in the paediatric age group, we need to pay special attention to postoperative pain and blood loss.

MATERIALS AND METHODS

This was a prospective, randomised controlled study of 120 patients in the age range of 3 to 69 years undergoing tonsillectomy and adenotonsillectomy in the Department of Otolaryngology in Kasturba Medical College, Mangalore from May 2008 to October 2009. The study was conducted after attaining clearance from the Ethical Committee KMC, Mangalore in April 2008. These patients underwent tonsillectomy using various surgical instruments like cold knife dissection, monopolar diathermy, bipolar diathermy and laser.

Inclusion Criteria

1. Patients with chronic tonsillitis.
2. Patients with chronic adenotonsillitis.
Exclusion Criteria
1. Patients with previous history of peritonsillar abscess.
2. Patients with history of bleeding disorders.
3. Patients with comorbid medical condition.
4. Patients with elongated styloid process.
5. Patients undergoing tonsillectomy as a part of some other surgery.
6. Patients who are immunocompromised.

There were 120 patients included in this study after obtaining a written informed consent from each of them. A detailed history was taken regarding their complaint; a thorough clinical examination was carried out and relevant investigations were done prior to surgery. Patients were randomly divided into three groups depending upon the surgical dissection instrument like bipolar diathermy, laser and monopolar diathermy used on the right side, keeping cold knife dissection constant on the left side.

Group 1- Patients undergoing bipolar electrodissection on the right side (n=40).
Group 2- Patients undergoing laser tonsillectomy on the right side (n=40).
Group 3- Patients undergoing monopolar electrodissection on the right side (n=40).

The operative time, blood loss, operative field, haemostasis, postoperative pain, fossae after one week and any complication was assessed for each method. No infiltration was used.

For each group tonsillectomy was carried out under general anaesthesia with the cold knife dissection carried out on the left side by incision of the anterior pillar with a sickle knife. After locating the peritonsillar plane, the tonsil was dissected towards the inferior pole with tonsillar dissector. The tonsil was removed with an Eve’s tonsillar snare. Throughout the procedure, blood was suctioned out using a mucus extractor and no cotton balls were used till the end of procedure. Haemostasis was achieved on the left side with ligatures.

Group 1- Bipolar dissection was carried out using the bipolar dissection forceps at a power setting of 20 to 40 W for coagulation and cutting modes. The dissection was done along the tonsillar capsule; vessels were identified as they entered the tonsillar capsule and were controlled by coagulation before cutting with the forceps. The dissection was carried out till the lower pole and the tonsil removed by coagulating the base at the lower pole and excising the tonsil. Control of bleeding was carried out using bipolar diathermy forceps and coagulating the bleeders.

Group 2- Tonsillectomy with laser was done with diode laser. The laser was used with all necessary precautions to protect the patient and theatre personnel. The laser optical fibre (220 μm) was held similar to that of a pen using contact or near contact for cutting and slight withdrawal from the tissue for coagulation. The incision is curvilinear down the entire length of the anterior pillar to define the tonsil capsule. With the tonsil retracted inferiorly and medially, the tonsil is dissected by releasing the fibrous bands from superior to inferior pole. Haemostasis was carried out using laser to coagulate the vessels.

Group 3- Tonsillectomy using the monopolar cautery was done with the power settings ranging from 10 to 40 W for the cutting and coagulation modes. The incision was made with monopolar blade on the mucosa just medial to the anterior pillar and dissection carried out with the same blade. The tonsil after dissecting up to the lower pole was removed with the cautery.

The operative time was recorded from the time of incision over the anterior pillar to removal of tonsil and until the end of haemostasis for each side. Haemostasis was achieved on each side before going to the opposite side. Blood loss was recorded with a separate suction apparatus with mucus extractor for each side. Cotton balls were not used during the entire procedure as measurement of blood loss would be hampered with. The surgeon for each type of procedure remained constant being well trained in the methods. Postoperatively, same analgesic was given for all the three groups. Postoperative pain scoring for each side was assessed before swallowing and after swallowing six hours postoperatively and the next two days. The pain scores were recorded on each side on a scale from zero to ten, where zero was no pain and ten was unbearable pain. Patients were mostly discharged on the second postoperative day and reviewed on the seventh postoperative day to assess the fossa and they were enquired about the pain scores on each side. The average of the pain scores were recorded for each side on the seventh day. Complications if any and the side was noted. The cause of the complication was determined.

RESULTS AND OBSERVATION
There were 120 patients who underwent tonsillectomy or adenotonsillectomy enrolled in our study. They were divided into three groups depending on the surgical dissection tool used on the right side keeping cold knife dissection (CKD) method constant on the left side.

Among the 120 patients, the minimum age of the patients was 3 years and the maximum was 69 years, 69(57.5%) patients underwent tonsillectomy and 51(42.5%) patients underwent adenotonsillectomy and there were 75(62.5%) males and 45(37.5%) females.

Intraoperative Time Taken
1. Bipolar Group- Cold knife dissection on the left side took mean time of 9.36 minutes and bipolar dissection on the right side took 12.33 minutes. The p value being 0.007 by Mann Whitney U test
2. Laser Group- The mean time taken for cold knife dissection method was 7.3 minutes and laser method was 11.03 minutes, p value 0.088
3. Monopolar Group- Mean time taken by cold knife dissection method was 9.16 minutes and monopolar dissection method was 10.32 minutes, p value 0.945 The time taken for bipolar electrodissection was significantly more as compared to cold knife dissection; however, there was no significant difference between laser and monopolar method compared to conventional dissection.
Intraoperative Blood Loss
1. Bipolar group: The mean blood loss for the cold knife dissection method was 15.6 mL and bipolar dissection method was 13.26 mL, p value 0.077.
2. Laser group: The mean blood loss by cold knife dissection method was 19.2 mL and by laser was 6.3 mL, p value 0.015.
3. Monopolar group: The mean blood loss by cold knife dissection was 21.68 mL and by monopolar diathermy was 20.8 mL, p value 0.515.

There was significantly less bleeding by laser method as compared to cold knife dissection. There was no significant difference in the blood loss between monopolar and bipolar method as compared to cold knife dissection method.

Postoperative Pain
The postoperative pain scores taken on an average is as follows for various methods.
1. Bipolar Group- The mean postoperative pain score on the cold knife dissection side was 6.16 while that on the bipolar side was 6.4. The p value was 0.856.
2. Laser Group- The mean postoperative pain on the cold knife dissection method was 5.1 while that on the laser side was 4.8. The p value being 0.588.
3. Monopolar Group- The mean postoperative pain on the cold knife dissection method was 5.84 while that on the monopolar side was 5.72. The p value being 0.874.

There was no significant difference in the postoperative pain between the various surgical tools and conventional dissection method.

Complications
Bipolar group: There were 2 cases of complications among the 40 patients, that is 5%. Among the two cases of complications, both were on the bipolar dissection side. One was a case of secondary haemorrhage presenting on the 4th postoperative day with minimal blood spit out. The patient was managed conservatively with intravenous antibiotics. The second case of complication was a child with low grade fever and the right tonsillar fossa was covered with abundant slough. The child was also managed conservatively. There was no statistical significance in the complications, the p value being 0.681 by chi square test.

There were no complications in the laser and monopolar group and on cold knife dissection side.

DISCUSSION
The steel blade and monopolar cautery has been the mainstay in surgical dissection for the majority of practicing otolaryngologists. Despite advances in technology and bioengineering, these two instruments remain widely used and are often preferred, although newer, emerging technologies have been demonstrated to improve surgical time, decrease bleeding, decrease postoperative pain, and reduce collateral tissue damage. The choice of the instrument may be dictated by the extent of the procedure (Complete tonsil removal versus partial tonsillectomy) and other considerations such as pain and post-operative bleeding. Electrosurgery began with the work of Cushing and Bovie in the 1920s. Tissue ablation with the Bovie monopolar cautery unit is achieved by introducing current across the physical gap between the source electrode and electrically conductive tissue using an electrode pair. With unipolar, it is difficult to control depth of heat coagulation & subsequent devitalisation. Since this will depend on the power released at the site of application and a small variation in tissue depth in tonsillar fossa can involve adjacent vital structures resulting in variable postoperative pain. Compared with standard scalpel, electrocautery provides an excellent tool for achieving cutting, ablation, coagulation, desiccation and rapid surgical haemostasis because the heat generated denatures proteins. With bipolar, area of tissue coagulation is localised between the fine tips of diathermy forceps causing less tissue damage in a more controlled and precise fashion resulting in less variable postoperative pain. The wavelength of diode laser being 980 nm has a high absorbance in water and haemoglobin. The thermal penetration depth is less than in the Nd:YAG laser. This allows safe and precise procedures to be performed close to delicate structures while protecting the surrounding tissue. Compared to the CO2 laser, this special wavelength exhibits a significantly better haemostasis and prevents bleeding during the operation, even in haemorrhagic structures. The risk of postoperative bleeding is minimal and the minimal amount of postoperative pain is due to faster healing. The advantages of laser tonsillectomy is microsurgical precision, tactile feedback from the laser fibre, minimal bleeding, few postoperative measures required and short
recovery period for the patient. In the study conducted by us the patients were aged between 3 and 69 years with 57.5% undergoing tonsillectomy and 42.5% undergoing adenotonsillectomy.

**Duration of Procedure**

In our study, the time taken by bipolar electrodissection was 12.33 min. which was significantly more (p = 0.007) compared to cold knife dissection method which took only 9.36 minutes. In a study by Isaacson et al., the bipolar electrodissection was performed at an average of 6 minutes but it was not compared with any other method. The comparative decrease in time could be due to the use of bipolar electroscissors used by Isaacson et al. as compared to the bipolar probes that we used. The bipolar probes needed constant cleaning of the charred tissue between its ends, thus increasing the time of dissection. In our study, laser tonsillectomy took 11.03 minutes as compared to 7.3 minutes for cold knife dissection method. There was no significant difference (p = 0.08) between the times taken for the two methods, although laser took longer than the conventional dissection technique. In a study by Hegazy et al., laser tonsillectomy was compared with bipolar radiofrequency tonsillectomy. In their study, laser took a mean duration of 12 minutes while bipolar took 10 minutes which was not statistically significant. In our study, monopolar electrodissection took 10.32 minutes and conventional dissection took 9.16 minutes and there was no statistically significant difference in the two timings (p = 0.845). In a study by Leach et al., the operative time by monopolar electrodissection was 13.5 minutes and dissection and snare method was 9.9 minutes. There was statistically significant difference between the two methods where the conventional dissection took much shorter time.

The decrease in intraoperative time helps in reducing the postoperative oedema subsequent to compression of tongue by mouth gag for prolonged periods. Bipolar tonsillectomy requires greater surgical time than monopolar electrodissection and laser because of frequent cleaning of char from the bipolar forceps. Division of tissue is similar with monopolar, bipolar method and laser but depth of tissue necrosis is less with bipolar electrodissection and least with laser.

**Blood Loss**

The blood loss by bipolar technique was 15.6 mL compared to 13.26 mL by dissection and snare method in our study. There was no significant difference between the two methods. In the study by Isaacson et al., there was no recordable blood loss and by Hegazy et al. the blood loss was 30 mL with bipolar electrodissection. In our study, the blood loss was significantly lower by laser tonsillectomy which was 6.3 mL as compared to 19.2 mL by conventional dissection method (p = 0.015). The blood loss in our study by laser tonsillectomy was lower compared to studies by Hegazy et al. and Magdy et al which was 21 mL and 20 mL respectively. The average bleeding by monopolar technique was 20.8 mL compared to 21.68 mL by conventional dissection method. There was no significant difference in blood loss in the two methods. Although in a study by Leach et al., the blood loss was significantly lower by monopolar method as compared to cold knife dissection method.

**Postoperative Pain**

There was no significant difference between the pain scores in our study between monopolar, bipolar and laser with cold knife dissection technique. However, a study by Leach et al. demonstrated significantly more pain by the monopolar cautery method as compared to the cold knife dissection method.

Pain may compromise a patient's ability to consume oral fluids, and this may lead to other problems such as volume depletion, fever and poor healing. Pain may thus lead to delayed recovery of the tonsillectomy patient. As surgeons, we should choose the method that minimises complications as well as has minimal postoperative pain. Complications: In our study, we had 2 cases (5%) of complications, one case of secondary haemorrhage on the side of bipolar tonsillectomy and one case of fever on the 7th day where there was abundant slough on the side of bipolar tonsillectomy. In a study by Isaacson et al., there were no complications with bipolar tonsillectomy among the 30 paediatric tonsillectomies, and there was one case of secondary hemorrhage each in the laser method by Hegazy et al. and monopolar tonsillectomy methods by Leach et al. respectively.

Less postoperative pain and more rapid healing after tonsillectomy can be achieved by preservation of maximum oral mucosa and minimum damage to tissues. Post tonsillectomy pain and bleeding continues to be a risk until the tonsillar fossae are completely mucosalised. Epithelial ingrowth from the cut edges of the anterior and posterior pillars provides much of this remucosalisation. Large tissue defects and thermal damage to the pillar mucosa can thus delay healing and increase the potential for discomfort and late complications. Electrosurgical instruments and laser all achieve cutting and simultaneous haemostasis by sealing the blood vessel lumen by virtue of tissue heating. Operative time and intraoperative blood loss are minimised when such devices are used. We alternated the side for comparison in the same person as the threshold for pain and healing capacity varies from person to person. The time taken for the laser tonsillectomy was not significantly more compared to conventional dissection; intraoperative blood loss was significantly less; average pain scores for the same method was the least compared to all other techniques and there were no complications associated with the procedure. The tonsillar fossa healed well at the end of one week. The only disadvantage for laser tonsillectomy is the additional cost compared to other techniques.

**CONCLUSION**

The study was aimed at finding out the ideal method of tonsillectomy with the best interests of our patients in mind. We concluded that laser tonsillectomy has the advantage of minimal blood loss and postoperative pain without any postoperative morbidity or complications. The cost factor is the only disadvantage of the procedure which prohibits all patients to agree to this technique. However, residents should be well versed with the conventional cold knife dissection method and the method of ligating bleeders with a tie before learning to use the various electrosurgical tools.
REFERENCES


