A Comparison between the Application of KTP Laser and Bipolar Radiofrequency in Tonsillectomy Operation for Pediatric Patients

Hegazy HM *§, Behiry A S*, Kaka AH §, Albirmawy OA*

Departments of Otolaryngology, Faculty of Medicine*, Tanta University Hospital, Tanta, Egypt, and Al Hammadi Hospital§, Riyadh, Kingdom of Saudi Arabia.

Background/Purpose: To compare the advantages and disadvantages of KTP laser with bipolar radiofrequency (RF) techniques in the operation of tonsillectomy in pediatric patients.

Patients and Methods: This prospective randomized clinical study was carried out during the period from July 2004 to January 2006. Eighty patients aged between 10 and 15 years old to whom Tonsillectomy operation was planned for chronic tonsillitis were included in the study. Patients were prospectively randomized into two equal groups: KTP laser tonsillectomy and bipolar radiofrequency tonsillectomy. Operative time and intra-operative blood loss were recorded. Patients were scheduled for follow up on the first, second and fourth postoperative week. They were asked to record their pain and discomfort on a standardized visual analogue scale from 0 (no pain) to 10 (severe pain). Postoperative complications were also recorded and managed.

Results: KTP laser group showed mild longer operative time (mean 12 minutes) than bipolar radiofrequency group (mean 10 minutes). The intra-operative blood loss was significantly less with KTP laser group (mean 21 cc) than bipolar radiofrequency group (mean 30 cc). In the first week, post-operative pain score was less in the KTP laser group than in bipolar RF group (means 7.5 and 8.5 respectively); however the pain score in the KTP laser group increased in the second week more than the bipolar RF group (means 8.5 and 6 respectively). In the fourth week, both groups showed nearly normal and equal pain score. There was no case of reactionary post tonsillectomy hemorrhage recorded in either group. Only one case of secondary post tonsillectomy hemorrhage was recorded in the KTP laser group (2.5%), managed conservatively and no secondary hemorrhage recorded in the bipolar RF group.

Conclusion: Both KTP and bipolar RF techniques are safe and easy techniques for tonsillectomy operation with reduced operative time, blood loss, rate of complication and better post operative general condition. KTP laser is associated with less intra-operative blood loss and immediate postoperative pain than bipolar RF technique; however, the operative time is relatively longer, and late postoperative pain is slightly more than in bipolar RF technique. The recorded low rate of complications proves the little damage effects of both techniques on the tonsillar bed during dissection of the tonsil, thus minimizing complications.

Index Word: Tonsillectomy, KTP laser, Bipolar radiofrequency.

INTRODUCTION

Tonsillectomy is one of the most common pediatric otolaryngology surgical operations done all over the world. Advancements in technology have affected the surgical methods of tonsil extraction for reaching the most effective technique, which reduces operative time, intra-operative blood loss, post-operative pain and possible hemorrhages.
Lasers have been used in otolaryngology for many years. The CO\textsuperscript{2} laser has been a popular tool for tonsillectomy and adenoidectomy and is claimed to be useful.\textsuperscript{1} However, the instrumentation is cumbersome and therefore not routinely used these days. Potassium-titanyl-phosphate (KTP/532) is an easily manipulated type of laser that could be delivered by an endostat fibre. Although the benefits of using KTP laser in tonsillectomy operation were questionable by some authors,\textsuperscript{2} while it was considered an ideal technique by others.\textsuperscript{3}

Bipolar radiofrequency tonsillectomy is a surgical procedure that uses radiofrequency (RF) tissue heating in dissection of the tonsil out of its bed aiming mainly for reduction of operating time and bleeding. Unlike electrosurgery, the tissues heat in response to the high frequency radio waves passing through it without heating the probes. The electrosurgical circuit includes the radiofrequency generator, active electrode, grounding pad, and the patient. Five distinct waveforms are produced and used: fully filtered, fully rectified, partially rectified, fulguration and bipolar. Each of these modes uses a combination of frequency, power, waveform, electrode size and time of application to produce a high tissue temperature results in a predictable tissue effects.\textsuperscript{4, 5}

The application of RF in airway was first demonstrated in an in-vivo porcine animal tongue model.\textsuperscript{6} Recently, RF has been shown to be safe and effective in bipolar tonsillectomy operations.\textsuperscript{7}

The aim of this study is to compare the advantages and disadvantages of these two new advanced surgical techniques in the operation of tonsillectomy in pediatric patients.

**MATERIALS AND METHODS**

This study was conducted between July 2004 and January 2006 in two ENT departments, Tanta University Hospital, Tanta, Egypt, and Al Hammadi Hospital, Riyadh, Kingdom of Saudi Arabia. This prospective randomized clinical study was designed to compare KTP laser tonsillectomy with the bipolar radiofrequency (RF) tonsillectomy. The local ethics committees approved the study protocol. All patients and their parents included in the study were fully informed about the nature of tonsillectomy operation and not the method of tonsillectomy operation either by KTP laser or by bipolar RF. An informed written consent was taken before inclusion in the study.

Eighty patients were included in this study (35 male and 45 female patients) aged from 10 to 15 years (mean 13 ± 1.3 years) who had recurrent attacks of acute tonsillitis and showed symptoms and signs of chronic tonsillitis. All patients had full ENT history and thorough clinical examination with full preoperative laboratory investigations. Forty patients were operated upon by KTP laser and bipolar radiofrequency was used in the other 40 patients.

Cases with bleeding disorders, previous quinsy, debilitating diseases, combined surgeries e.g. adenotonsillectomy operation were not included in this study.

**Techniques**

All procedures were done under general anaesthesia with cuffed oral endotracheal tube. The child was put in supine position with the table head at 20 degree below horizon and sand bag under his shoulders. The mouth was opened by with the self-retaining Boyle-Davis mouth gag.

In the KTP laser group, a KTP 532 (Laserscope) laser was used (Fig. 1). The machine was set to 10 W continuous beams for the initial dissection and a defocused beam was used for hemostasis. The laser beam was delivered via a 0.6 mm EndostatFM fiber. All precautions for safety of theatre personnel during the use of the laser were followed.

In the bipolar RF group, Ellman surgitron model F.F.P.F., 3.8 MHz (Ellman international inc, Hewlett, NY, USA) was used (Fig. 2) with bipolar (partially rectified) mode with an intensity of 5 in dissection of the tonsils, bleeding points were also stopped by intensity 6 bipolar RF application.

All patients received standard postoperative care and discharged after one day with home medications composed of antibiotic, analgesic and mouth wash for 7 days. Patients were scheduled for follow up on the first, second and fourth post operative week. They were asked to record their pain and discomfort on a standardized visual analogue scale from 0 (no pain) to 10 (severe pain). The parents were asked about the smoothness of recovery in the early postoperative period, fever, emesis, neck stiffness, and the time period required returning to the patient's normal diet.
and daily activities. Postoperative complications were also recorded and managed.

The main outcome measures in this study were:

- Operative time (measured from the introduction to the removal of the Boyle-Davis mouth gag), which calculates the excision time of tonsils and hemostasis.
- Intra-operative blood loss measured by using the weight of saturated swabs and adding it to the blood volume measured in an accurate pediatric container attached to the suction bottle.
- Postoperative pain and discomfort with eating and drinking at various intervals during the first, second and fourth weeks (measured by visual analogue scale (VAS)).
- Rate of postoperative complications such as reactionary or secondary bleeding and/or infection.

**Statistical Analysis**

The analysis was performed using SPSS Windows statistical software package. Data were expressed, as mean ± SD. P values less than .05 were considered significant. Parametric tests such as t test were applied for data that follow a normal distribution. Non-parametric tests such as Mann-Whitney u test and x² test were applied for data that did not follow a normal distribution.

### RESULTS

**Operative Time**

There was a tendency for shorter operative time in the radiofrequency group, but this did not reach a statistical significance (P > .05) (Table 1). The time in the RF group ranged from 6 to 14 minutes with 2 minutes less in the mean operative time, when compared with the KTP Laser group (range, 9 to 15 minutes.)
Blood Loss
The amount of blood lost during KTP Laser tonsillectomy group ranged from 21 to 30 mL (with a mean significant difference of 9 mL) when compared with the RF group which blood loss was ranging from 25 to 35 mL (P < .05) (Table 1).

Visual Analogue Scale
The pain and discomfort score by the visual analogue scale in the first week was ranging from 6 to 9 in the KTP Laser group (mean 7.5 ± 1.11); while it was ranging from 7.5 to 9.5 in the bipolar RF group (mean 8.5 ± 0.5) without statistical evidence for a significant difference (P > .05) (Table 1). However, in the second week follow up visit, the pain score has increased in the KTP Laser group reaching a mean of 8.5 ± 0.47 (range 7.5 – 9.5); while it decreased in the bipolar RF group to 6 ± 0.31 (range 5 -7), this failed to show a statistical significant difference (P > .05). After four weeks, both groups showed improvement in an equal degree with reduction of the pain score to normal levels.

Postoperative Sequelae and Complications
No evidence for statistically significant difference between the two groups regarding postoperative emesis, fever, neck stiffness, administration of analgesia, and time needed to return to preoperative diet and activities. There was no recorded reactionary hemorrhage in either group of patients. Only one case in the KTP Laser group (2.5%) developed secondary hemorrhage after two weeks of surgery and was managed conservatively by broad spectrum intravenous antibiotic and Bovidone Iodine mouth wash.

DISCUSSION
The implementation of new technologies in the surgical procedures has encouraged surgeons to use the new techniques in their practice to achieve the ultimate goals of their surgeries. The principal aim of tonsillectomy operation is to extract the tonsils completely with an easy procedure, short operating time, minimal blood loss, minimal post operative pain and discomfort, reasonable costs and without complications. There have been studies comparing KTP laser tonsillectomy and bipolar RF tonsillectomy alone with the instrumental cold dissection method. Up to our knowledge there are no previously published studies comparing the two new technologies with each other.

In this series, the age of the studied patients was ranging between 10 to 15 years old. The purpose for selection of this pediatric age group was to get as much as possible an accurate estimation of the degree of postoperative pain and discomfort and its changes in the follow up visits.

In this study, KTP laser tonsillectomy showed mild increase in operative time (mean 12 min) than Bipolar RF tonsillectomy (mean 10 min). This could be attributed to the more time needed to set up the laser system, the precautious measures during the procedure and the possible laser malfunctions. The mean operative time recorded for both techniques is consistent with that recorded by previous trials for KTP (median 12 min) and Bipolar RF (mean 8.5 min).

There was a significant decrease in the intra-operative blood loss in the KTP laser group (mean 21 ml) in relation to the bipolar RF group (mean 30 ml). The overall advantage of KTP laser in this point of outcome in relation to the small amount of blood loss could be beneficial in special cases of tonsillectomies for children and patients with bleeding disorders in whom it is important to reduce significant blood loss. The mean intra-operative blood loss recorded for KTP Laser technique is in concordence with that recorded by previous trials for KTP (median 20 cc), Bipolar RF group was more than the bipolar RF group recorded in another study (mean 13 cc).

The KTP laser group showed slight less post operative pain and discomfort score by the visual analogue scale in the first day until the end of first week (mean 7.5), while in bipolar RF group, the mean was 8.5. During the second postoperative week, the pain score for the KTP laser group was more than the bipolar RF group (8.5 and 6 respectively). At the 4th week, the two groups were nearly equally improved.

The pain score in bipolar radio frequency group results were consistent with Ragab, who had a mean pain score of 8.5 in the first postoperative day compared with his cold dissection group (mean 9). The results of KTP laser group were different from that recorded by Kothari et al, who had high post operative pain score in their KTP laser group on the first post operative day that abolished gradually by the end of the first month.
The KTP laser is claimed to reduce immediate postoperative pain because of its effect of desensitizing the terminal nerve endings. Oas and Bartels, reported that this benefit is lost by the end of the first week and tends to last longer in a significant number of patients before abolishing completely later on. Kulaskar suggested that one of the causes of increased post operative pain may be the surgical technique and recommended that the laser beam should be directed to the tonsil tissue and not to the tonsillar fossa laterally as this causes thermal damage to the muscle bed and hence post operative pain. Strunk and Nichols found that their KTP laser group had a great amount of exudates on the first to second postoperative week follow up visits. Auf et al noted that the wound healing was slower in their KTP laser side, with increased slough after two weeks and reduced rate of healing. These findings could explain the higher pain score of the second postoperative week recorded in our study.

The use of bipolar radiofrequency waves in dissection and hemostasis during tonsillectomy had minimized lateral heat and thermal damage to the tonsillar bed and, hence, decreasing post operative pain and scarring beside the lower cost of the device compared with laser.

The incidence of postoperative complications for KTP and Bipolar RF groups was minimal for both groups. In our study, reactionary hemorrhage was not recorded in either patients of the KTP laser or the bipolar RF groups while the incidence of secondary hemorrhage was only one case (2.5%) for KTP laser and none in the Bipolar RF groups.

CONCLUSIONS

Both KTP and bipolar RF are safe and easy techniques for tonsillectomy operation. KTP laser is associated with less operative blood loss and less immediate postoperative pain and discomfort than bipolar RF technique. However, it needs slightly more operative time and causes more late postoperative pain and discomfort than bipolar RF technique. The recorded small rate of complication shows the little damage effects of both techniques on the tonsillar bed during dissection of the tonsil, thus minimizing complication.

Recommendations

- Enrolling more patients in each group for more accurate statistical analysis.
- Including the cold dissection technique as a third group in future comparative studies as it is considered the gold standard in tonsillectomy operation.
- Early and late histopathological examination of the tonsillar bed and tissue for evaluation of the effect of each technique on these tissues.

REFERENCES