

Coblation: An Alternative to CO₂ Laser and Microdebrider for Laryngeal Papillomatosis

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Abstract

Objective: To assess the efficacy of coblation in treating laryngeal papillomatosis and its effect on post operative voice outcome. **Study Design:** This is a retrospective study. **Setting:** Tertiary referral centre. **Subjects and Methods:** All the patients diagnosed with laryngeal papillomatosis between January 2013 to December 2016 were included in this study. Preoperative assessment was done with rigid and flexible laryngoscopy. PRAAT software was used for voice analysis. All patients underwent coblation assisted microlaryngeal surgery. Post operatively patients were followed up at 1 week, 15 days, 1 month, 3 months and 6 months with rigid laryngoscopy. Voice analysis was repeated after 3 months to assess the improvement in voice. **Results:** Coblation was found to be effective in treating laryngeal papillomatosis. In our series of seven patients, three patients underwent repeat procedure with coblation for recurrence. But longterm follow up these patients did not reveal any recurrence of laryngeal papillomatosis. Voice analysis revealed a significant improvement in measures of perturbation and maximum phonation time. **Conclusion:** Coblation is a promising alternative to the conventional methods for the treatment of laryngeal papillomas as it can achieve satisfactory disease clearance with good voice quality.

Keywords

Coblation, Microlaryngeal Surgery, Laryngeal Papillomatosis, JORRP, Recurrent Respiratory Papillomatosis, Laser, Microdebrider

1. Introduction

Recurrent respiratory papillomatosis (RRP) is characterized by the development of exophytic proliferative lesions of connective tissue covered by epithelium which affect the mucosa of the respiratory tract. HPV 6 and 11 accounts for

most cases of laryngeal papillomatosis. RRP shows bimodal age distribution. Juvenile form develops in less than 20 years of age while adult form develops in more than 20 years of age in third and fourth decade of life. There is a strong predilection for larynx hence it is also termed as laryngeal papillomatosis or glottal papillomatosis. The incidence of laryngeal papillomatosis is approximately 4.3 per 100,000 children and about 1.8 per 100,000 adults in the United States [1]. Laryngeal papillomatosis is a rare and benign condition but it can cause significant morbidity due to obstruction of airway, repeated recurrences and spread to distal airways. Mainstay of treatment is surgical debulking of tumour to secure airway while preserving underlying laryngeal tissues and maintaining acceptable voice quality. Surgical removal using lasers is the traditional standard of treatment. Microdebridors have been gaining popularity since it avoids the potential problems caused by lasers [2]. In this study, we present a series of cases of laryngeal papillomatosis treated with coblation and their long term follow up.

2. Materials and Methods

This is a retrospective study conducted at Dr Deenadayal's ENT Care Centre which is a tertiary referral centre. All patients diagnosed laryngeal papillomatosis between January 2013 to December 2016 were included in the study. All patients were evaluated preoperatively with 70° and 90° rigid video laryngoscopy and flexible laryngopharyngoscopy, and derkay severity score noted. According to the Derkay staging system—in which the aerodigestive tract is divided into 25 subsites, each of which is given a score of 0 to 3 (0 = no lesion, 1 = surface lesion, 2 = raised lesion, 3 = bulky lesion (**Figure 1**)). Pre-operative objective voice analysis was done using PRAAT software. Voice of all the patients was recorded so as to compare the pre-op voice with that after the treatment. All voices were recorded following a standard procedure, both before and after treatment. The recorded voice sample included counting from 1 to 10, prolonged /a/, /o/ and /i/ vowels, and a paragraph in the language patient can read which was kept constant for all the patients. Maximum phonation time was noted by asking the patient to inhale as deeply as possible and sustain a steady vowel for as long as possible. This was repeated three times and the longest of the three measurements was taken. After the pre-operative assessment, the patients taken up for microlaryngeal surgery. Under general anaesthesia with the patient in Boyce's position, Klein Saucer suspension laryngoscope was introduced. Operating microscope with objective lens of 400 mm was used to visualise the vocal cords. PROCISE LW laryngeal wand was first used to debulk the lesions. PROCISE MLW laryngeal wand was used to clear papillomas near the vocal cords. The power level was set to 6 for coblation and 3 for coagulation. Post operatively, each patient was given antibiotic and anti-inflammatory for 1 week, antacid for 1 month and absolute voice rest for 1 week followed by speech therapy and spirometry exercises. Patients were regularly followed up at interval of 1 week, 15

| FOR EACH SITE SCORE AS 0 = NONE; 1 = SURFACE LESION; 2 = RAISED LESION; 3 = BULKY LESION | |
|---|-------|
| SITE | SCORE |
| Epiglottis – lingual surface | |
| Epiglottis – laryngeal surface | |
| Right aryepiglottic fold | |
| Left aryepiglottic fold | |
| Right false vocal fold | |
| Left false vocal fold | |
| Right true vocal fold | |
| Left true vocal fold | |
| Right arytenoid | |
| Left arytenoid | |
| Anterior commissure | |
| Posterior commissure | |
| Subglottis | |
| Trachea-upper one-third | |
| Trachea-middle one-third | |
| Trachea-lower one-third | |
| Right bronchus | |
| Left bronchus | |
| Tracheotomy stoma | |
| Nose | |
| Pharynx | |
| Esophagus | |
| Lungs | |
| Other | |
| TOTAL ANATOMICAL SCORE | |

Figure 1. Anatomical Staging System as proposed by Derkay *et al.* [3].

days, 1 month, 3 months and 6 months. Assessment of vocal cords was done with 70° rigid video laryngoscopy at each visit. Stroboscopy and voice analysis was repeated 3 months after surgery, and pre-and post-operative findings were compared to quantify improvement in voice.

3. Results

Seven patients were diagnosed with laryngeal papillomatosis from January 2013 to December 2016. Six patients were female while one was male ranging from 19 years to 60 years (mean age 45.4 years). The number of years with disease varied from 1 month to 15 years. All patients presented with change in voice. Four (Pa-

tient 1, 2, 3 and 4) out of seven the patients had undergone surgery for papillomatosis previously (**Table 1**). Preoperatively average derkey severity staging was 6.7, highest being 10 and lowest being 3. All the patients underwent coblation assisted resection of laryngeal papillomatosis. Three patients (Patient 1, 3 and 4) had excessive slough following the procedure requiring slough removal one-week post operatively. There were no complications noted perioperatively and postoperatively. Four patients had recurrence following surgery out of which 3 patients underwent repeat procedure using coblation while one patient was lost to follow up. These three patients did not show any recurrence following the repeat procedure with coblation on long term follow up (**Table 2**). **Figure 2** and **Figure 3** show pre and post operative laryngoscopic pictures following coblation assisted excision of the laryngeal papillomas.

Voice analysis and stroboscopy was done after 3 months after surgery. In cases of recurrence, voice analysis was repeated after the second procedure. Change in acoustic parameters of voice after surgery are shown in **Table 3**. Voice analysis did not reveal much change in pitch and intensity of voice post operatively. There was a significant improvement noted in measures of perturbation *i.e.* jitter and shimmer. Improvement in jitter was more as compared to shimmer *i.e.* perturbation in pitch improved more than perturbation in intensity

Table 1. Demographics of patients.

| PATIENT | AGE | SEX | TIME WITH DISEASE | NUMBER OF PREVIOUS PROCEDURES |
|---------|-----|--------|-------------------|-------------------------------|
| 1 | 52 | Female | 3 months | 3 times with cold instruments |
| 2 | 47 | Female | 15 years | 2 times with cold instruments |
| 3 | 60 | Female | 1 year | 2 times with cold instruments |
| 4 | 20 | Female | 15 years | 1 time with cold instruments |
| 5 | 19 | Male | 3 months | None |
| 6 | 60 | Female | 2 years | None |
| 7 | 60 | Female | 1 month | None |

Table 2. Recurrences following coblation.

| Patient | Derkey Severity Scoring | Number of recurrences after coblation | Time of recurrence after coblation | Treatment for recurrence | Current Status | Duration of follow up |
|---------|-------------------------|---------------------------------------|------------------------------------|--------------------------|-------------------|-----------------------|
| 1 | 9 | None | - | - | No recurrence | 1 year |
| 2 | 9 | 1 | 1 month | Coblation | No recurrence | 2 years |
| 3 | 10 | 1 | 1 month | Coblation | No recurrence | 1 year |
| 4 | 6 | 1 | 6 months | Lost to follow up | Lost to follow up | Lost to follow up |
| 5 | 3 | None | - | - | No recurrence | 1 year |
| 6 | 4 | None | - | - | No recurrence | 6 months |
| 7 | 6 | 1 | 1 month | Coblation | No recurrence | 2 years |

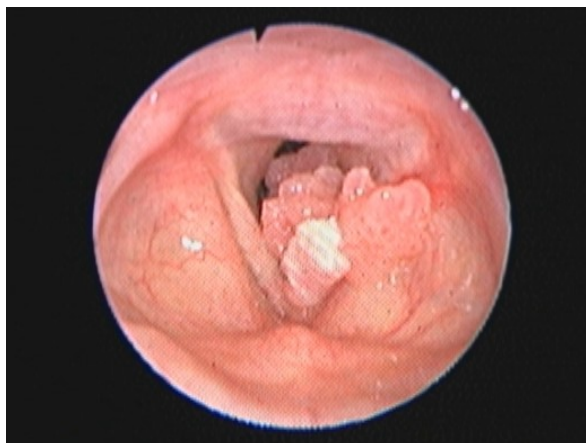


Figure 2. Rigid Laryngoscopic appearance pre-operatively.



Figure 3. Rigid Laryngoscopic appearance 2 years post operatively.

Table 3. Improvement in acoustic parameters of voice.

| Parameter | Pre-op | SD* | Post-op | SD* | Percentage improvement | p Value |
|--------------------------|--------|--------|---------|-------|------------------------|---------|
| Pitch (Hz) | 236.06 | 106.01 | 208.63 | 50.09 | 11.62% | 0.4 |
| Intensity (dB) | 61.31 | 12.62 | 62.30 | 8.27 | 1.60% | 0.8 |
| Shimmer (dB) | 1.86 | 0.62 | 0.92 | 0.38 | 50.53% | 0.03 |
| Jitter (%) | 5.94 | 4.06 | 0.813 | 0.77 | 86.30% | 0.02 |
| Harmonics to Noise Ratio | 3.98 | 4.52 | 13.26 | 5.62 | 233% | 0.01 |
| MPT(seconds) | 5.85 | 2.79 | 10.57 | 3.15 | 80.60% | 0.002 |

*SD—Standard Deviation.

after surgery. Harmonics to noise ratio increased by almost 3 times after surgery, from an average of 3.98 dB pre-operatively to 13.26 dB post-operatively. Maximum phonation time showed 80.6% increase after surgery. In all cases mucosal waves on stroboscopy was found to be normal post-operatively.

4. Discussion

In 1976, Hirano described the vocal folds as a layered structure according to a body cover model. The cover consists of the overlying epithelium and superficial lamina propria. The body is formed by the vocalis muscle. Between these two layers is the transition zone composed of the intermediate (elastic) and deep (collagen) layers of lamina propria which together make up the vocal ligament. The preservation of the relationship between the cover, the transition zone and body is essential for favourable voice outcome postoperatively. Any injury to the vocal fold will result in scarring eventually compromising the quality of voice. Patients with recurrent respiratory papillomatosis may be subjected to repeated surgical procedures due to multiple recurrences, which increases the risk of vocal fold scarring.

Controlled ablation (coblation) is a radiofrequency bipolar method of tissue destruction in which electric current runs through a steady flow of irrigating saline, resulting in polarization of the sodium ions causing local tissue destruction at the tip of the coblation wand. The coblation technique works at 60°C as opposed to CO₂ laser that can heat charred tissue to temperatures greater than 400°C [4].

The risk of airway fire is reduced with the use of coblation [5]. Coblation also avoids the potential complications of laser like scarring, stenosis and seeding of virus via laser plumes. It also results in less peripheral damage and inflammatory reaction than laser. Coblation wand combines suction, ablation and coagulation in one instrument unlike lasers and microdebriders, thus helps in providing a clear surgical field. Use of coblation was also found to result in less intraoperative bleeding [6] and reduced operative time [7]. The PROCISE LW laryngeal wand has a working length of 16.5 cm with a 45-degree angulation 3 cm off the handle and 15-degree angulation at the tip allowing optimal access to larynx. The shaft of the wand is malleable which can be used to adapt to the patient anatomy giving it an edge over the rigid microdebriders. The PROCISE MLW laryngeal wand has a working length of 19 cm with an angulation to 50-degree 3 cm off the handle and a 16-degree angulation at the tip allowing access to subglottis and trachea. Also shaft of the wand is ultra-slim (outer diameter is 2.8 mm) which improves the visualization of the field. Single wire electrode at the tip provides precise removal of small lesions.

There have been various studies that have shown coblation to be a promising tool in the treatment of laryngeal papillomas but none of these studies have analysed the voice [7] [8] [9] [10]. In our study, we analysed the voice pre and post operatively and found that there was significant improvement in jitter, shimmer and harmonics to noise ratio. Maximum phonation time also increased significantly. This indicates the vibratory characteristics of the vocal folds were maintained post operatively. Additional speech therapy post-operatively also helped in improving the voice quality of the patients.

Study by A.S Carney *et al.* found that coblation resulted in longer periods be-

tween interventions as compared to CO₂ laser [7]. In our series, three patients showed recurrence one month post operatively with a derkay severity score of 2. These patients were immediately taken up for surgery. The repeat procedure was also done using coblation. Since the recurrences were small in size, complete clearance of the disease could be achieved. Long term follow up of these patients did not show any recurrence.

Post operatively stroboscopy was repeated and all cases were found to have a normal mucosal wave pattern indicating that the vocal fold architecture was maintained even after surgery. There was no vocal cord scarring even in cases that underwent a repeat procedure.

Thus, with coblation satisfactory disease clearance and reduced frequency of recurrence can be achieved with a good voice quality.

5. Conclusion

Coblation is a unique tool that can be used for suction, ablation as well as coagulation that can help in complete removal of papillomas without damaging the underlying architecture of the vocal cords, reduces the frequency of recurrence and also results in a good voice post-operatively. It may be used as an alternative to the current methods of treatment of laryngeal papillomas.

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