

Original Article

Comparison between Conventional Microdissection and CO₂ Laser in the Treatment of Vocal Cord Polyp

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Abstract:

Background: Vocal cord polyp usually arises from the epithelium and the lamina propria. Minimally invasive dissection procedures are employed to treat these vocal cord polyp for an effective outcome. Two types of microsurgical techniques were developed gradually and practiced namely, the conventional laryngeal microsurgery, which involves the use of cold instruments and the laryngeal laser micro-surgery.

Objective: To compare the conventional cold dissection and CO₂ laser methods in treatment of vocal cord polyp.

Methods: A randomized prospective study was conducted at the Department of Otolaryngology-Head & Neck Surgery, at Bangabandhu Sheikh Mujib Medical University (BSMMU) between July 2017 and June 2019. A total of 60 cases were studied on the following parameters: a. Visual analysis on stroboscopy b. Voice analysis –GRBAS (grade, roughness, breathiness, asthenia, strain) indices c. Duration of surgery d. Peroperative bleeding.

Results: During first postoperative assessment, both groups had the normal symmetrical waves, while 50% of cases still had aperiodicity but all patients had the near normal periodicity in the second postoperative assessment. Regarding glottic closure, during preoperative assessment, almost all patients had incomplete glottic closure due to mass lesion as polyps. During first postoperative assessment, glottic closure was found to be better in group B (83% of cases) than group A (76% of cases), while during second postoperative assessment, all patients of both groups had around 95% glottic closure. The mean duration of laser technique (7.1 ± 1.1 minutes) was less than the conventional technique time (15.6 ± 1.9 minutes), also mean of operative bleeding of laser technique (zero pack) is less than the conventional two (2 packs).

Conclusion: There is no significant difference between both groups in all parameters except operative time and bleeding, as laser technique has less time and clear field.

Key words: Conventional microlaryngeal surgery, CO₂ laser, Stroboscopic examination, GRBAS indices

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Introduction:

Vocal cord polyp usually arises from the epithelium and the lamina propria. The incidence of vocal cord polyp has been increasing due to vocal abuse¹. Misuse of voice lead to excessive mechanical stress and trauma in the membranous portion resulting in wound formation in the vocal fold leading to development of vocal cord polyp². The pathological changes occur within the superficial layer of the lamina propria. Minimally invasive dissection procedures are employed to treat these vocal cord polyp for an effective outcome^{3,4}. Two types of microsurgical techniques were developed gradually and practiced namely, the conventional laryngeal microsurgery, which involves the use of cold instruments and the laryngeal laser micro-surgery^{2,4,12}.

The aim of micro-laryngeal surgery is to restore the normal function of vocal folds and to avoid injury of deep layers to prevent scarring of vocal folds⁵. The cold knife is the conventional method to remove superficial lesions of vocal folds. The lesions are micro dissected from the superficial layers preserving the deep layer of lamina propria and the vocal ligament to help good healing and avoid scarring of vocal folds^{5,6,13}. Nowadays, there is a great development in using the laser in micro-laryngeal surgeries⁷. The CO₂ laser allows surgeons to achieve better intra-operative homeostasis, minimal tissue damage and manipulation. Using laser makes it easy for the surgeon to resect superficial lesions without affecting the waveform of the vocal fold mucosa⁸. In this study, both micro surgical techniques by cold steel and laser have been compared in the management of vocal cord polyp. The groups were assessed through vocal cord morphological observation by video stroboscopy and by comparative analysis of subjective voice assessment parameters

using GRBAS. The GRBAS scale is an expert auditory perceptual assessment to evaluate the grade of dysphonia of the voice. The severity of dysphonia is quantified under five parameters: G (grade), which represents overall voice quality, R (roughness): irregular glottic pulses, B (breathiness): turbulent air leakage through an insufficient glottic closure, A (asthenicity): weakness in the spontaneous phonation, S (strain): an excessive force associated with spontaneous phonation. Each item is graded from 0 to 3: 0 = no perceived abnormality, 1 = mild abnormality, 2 = moderate abnormality and 3 = severe abnormality^{7,8,9,15}. Stroboscopic examination is an expert subjective assessment of vocal folds which examines its function and biomechanics, so it can determine the myriad of vocal fold pathologies. Specifically, it evaluates several parameters of the vibration cycle, including fundamental frequency, periodicity, closure of the glottis, and vocal fold symmetry^{9,10,19}.

Aims and Objectives:

The aim of the study is to compare the conventional cold dissection and CO₂ laser methods in treatment of vocal cord polyp.

Methods:

A randomized prospective study was conducted at the Department of ENT and Head-Neck Surgery, at Bangabondhu Sheikh Muzib Medical University (BSMMU) between July 2017 and June 2019. A total of 60 cases were studied on the following parameters:

- a. Visual analysis on stroboscopy
- b. Voice analysis – GRBAS indices
- c. Duration of surgery
- d. Perioperative bleeding

Written and informed consent was taken prior to surgery for each patient.

Exclusion criteria:

1. Age below 17 years
2. Professional singers and actors
3. Patient unfit for general anaesthesia
4. Pregnant women and mentally impaired persons

All patients were encouraged to have a trial of conservative medical and rehabilitative therapy before consideration of surgery. This included voice therapy; general voice hygiene efforts such as voice moderation, hydration, mucolytics and humidification; smoking cessation; and anti-reflux diet with or without anti-reflux medications.

Patients were generally taken up for surgery on persistence of symptoms on failure of medical treatment for at least 6 weeks. Patients were then assigned to the following two groups by the total consecutive sampling method:

A. Microdissection group

B. Laser excision group

All the patients underwent surgery under general anaesthesia. Laser safe endotracheal tubes were used for intubation in patients of the laser excision group. Operating microscope at 400-mm focal length through a suspension laryngoscope was used for all surgeries.

Group A

The vocal fold lesion was pulled to the midline by a forceps and excision was done along vocal folds edge by micro-scissor. Homeostasis was achieved by a compression on the wound by a piece of gauze soaked with adrenaline.

Group B

All laser precautions were applied. The Carl Zeiss CO₂ laser with 2 W power, super-pulse mode and interval 0.2 ms were connected to the microscope by a micromanipulator with 250-mm spot size. The surgeon put a piece

of gauze in subglottic space to protect the endotracheal wall from a laser beam. The vocal fold lesion was pulled to the midline by forceps and excision was done along the edge of vocal folds by using CO₂ laser. A piece of gauze soaked with adrenaline was used to clean surgical wounds. The vocal fold's muscle was protected to avoid deep injury and scar.

All patients were received intraoperative corticosteroids to prevent laryngeal edema then turned over to anesthesiologist for extubation and all lesions were sent to histopathological examination. All surgical interventions were done by the same surgeon.

Postoperative care and follow-up:

All patients have received antibiotics, anti-inflammatory and anti histamine, H₂ blocker drugs, and were counseled to have voice rest, plenty of fluids, and to avoid smoking. Both groups were compared accordingly. Operative time: measured in minutes. (Conventional method: the operative time was estimated from first mucosal incision by micro scissor till completion of homeostasis by a piece of gauze soaked with adrenaline & CO₂ laser method: the operative time was estimated from first mucosal incision by CO₂ laser till completion of hemostasis.) II. Bleeding: was measured by number of pieces of gauze used for hemostasis. III. Functional assessment was done three times on the basis of stroboscopic examination and GRBAS indices: first assessment was done before the surgical intervention, 2nd assessment was done after 1 month of the operation and the final assessment was done after 3 months of the operation.

Data management:

Data were analyzed by SPSS version 18. Normally distributed scale data were described as mean and standard deviation. Categorical data were presented as number and percent. Comparison between groups regarding a categorical variable was done using chi-square test.

Results:

Group A was 30 patients underwent the conventional cold dissection method and group B was 30 patients underwent CO₂ laser dissection method. Here we compared between the twomethods regarding GRBAS scale, stroboscopic examination, surgical time and amount of bleeding.

Preoperative assessment by stroboscopic examination revealed that all patients in both

groups had incomplete glottic closure, asymmetrical motion, absent mucosal wave, & decreased amplitude with aperiodicity. During post-operative assessment, there was no statistically significant difference between both groups regarding glottis closure, asymmetrical motion, mucosal wave, amplitude, and periodicity. Also there was no statistically significant difference between both groups regarding their quality of voice parameters (GRBAS scale)

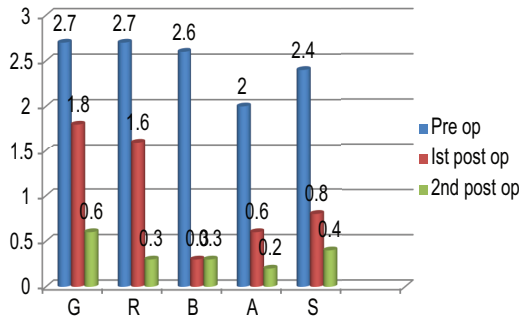


Fig 1 : A comparison of GRBAS scale of Group A during preoperative, first postoperative and second postoperative assessments.

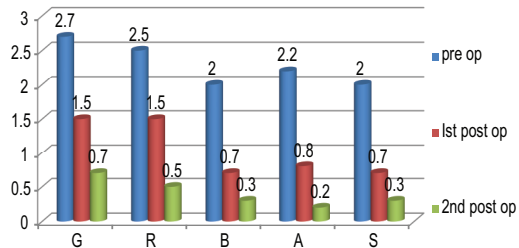


Fig 2: A comparison of GRBAS scale of Group B during preoperative, first postoperative and second postoperative assessments.

Table I :

Stroboscopic Findings in Group A during Preoperative, First Postoperative and Second Postoperative Assessments.

Finding	Pre operative assessment n (%)	1st post operative assessment. n (%)	2 nd post operative assessment n (%)	P value (bet. Pre-op and 2 nd post-op assessment)
Glottic Closure				
Incomplete	30 (100%)	7 (23.33%)	2 (6.66%)	< .032
Complete	0 (0%)	23 (76.66%)	28 (93.33%)	
Symetrical motion				
Asymetrical	30 (100%)	5 (16.66%)	3 (10%)	< .036
Symetrical	0 (0%)	25 (83.33%)	27 (90%)	
Mucosal wave				
Absent	30 (100%)	10 (33.33%)	2 (6.66%)	< .032
Present	0 (0%)	20 (66.66%)	28 (23,33%)	
Amplitude				
Decreased	30 (100%)	8 (26.66%)	5 (16.66%)	< .045
Normal	0 (0%)	22 (73.33%)	25 (83.33%)	
Periodicity				
Aperiodic	30 (100%)	15 (50%)	3 (10%)	< .036
Periodic	0 (0%)	15 (50%)	27 (90%)	

Table II :
Stroboscopic finding in Group B during pre-operative, first post operative and second post operative assessment.

Finding	Pre operative assessment n (%)	1st post operative assessment n (%)	2 nd post operative assessment n (%)	P value(bet pre-op and 2 nd post op. assessment)
Glottic Closure				
Incomplete	30 (100%)	5(16.66%)	1(3.33%)	< .012
Complete	0 (0%)	25 (83.33%)	29(96.66%)	
Symmetrical motion				
Asymmetrical	30 (100%)	4(13.33%)	2(6.67%)	< .032
Symmetrical	0 (0%)	26(86.66%)	28(93.33%)	
Mucosal wave				
Absent	30 (100%)	5(16.66%)	2(6.67%)	< .032
Present	0 (0%)	25(83.33%)	28(93.33%)	
Amplitude				
Decreased	30 (100%)	7(23.33%)	4(13.33%)	< .041
Normal	0 (0%)	23(76.67%)	26(86.33%)	
Periodicity				
Aperiodic	30 (100%)	16(53.33%)	3(10%)	< .036
Periodic	0 (0%)	14(46.66%)	27(90%)	

Table III :
Comparison between Group A and Group B regarding operating time (min)

Operating time	Group A (30 cases)	Group B(30 cases)	P value
Mean	15.60	7.1	<.001
SD	1.9	1.1	
Median	15.1	6	
Minimum	11	3	
Maximum	20	10	

In this study, there is a statistically significant difference between both groups regarding the operative time and bleeding in favor of laser technique. The mean duration of laser technique (7.1 ± 1.1 minutes) was less than the conventional technique time (15.6 ± 1.9 minutes), also mean of operative bleeding of laser technique (zero pack) is less than the conventional two (2 packs).

Discussion:

Newer microlaryngeal instruments have been developed which allow precise microscopic excision of vocal fold lesions with preservation of the deep layer of the lamina propria and muscle layer. Development of the videostroboscope has allowed surgeons to assess the impact of their surgery on the subtle features of vocal fold vibration. Stroboscopy provides excellent real time

mucosal wave movement endoscopically and helps in evaluating pattern of mucosal fold vibration, Regrowth of normal mucosa and subsequent normal waveforms was seen on videostroboscopy following microlaryngeal excision of benign lesions^{16,19}.

In this study, during preoperative assessment, stroboscopic examination revealed that asymmetry and aperiodicity of mucosa of vocal folds were the main finding in both groups. During first postoperative assessment, both groups had the normal symmetrical waves, while 50% of cases still had aperiodicity but all patients had the near normal periodicity in the second postoperative assessment. The mucosal wave had marked improvement in both groups and there was no remarkable difference in the degree of improvement of wave amplitude. Regarding glottic closure, during preoperative assessment, almost all patients had incomplete glottic closure due to mass lesion as polyps. During first postoperative assessment, glottic closure was found to be better in group B (83% of cases) than group A (76% of cases), while during second postoperative assessment, all patients of both groups had around 95% glottic closure. In this study, the laser had better results during the first postoperative assessment but there was no significant difference between both techniques during the second postoperative assessment. This is matched with previous studies like Benninger who did not detect any clinical outcome differences in 37 patients with vocal fold polyps, cysts, and nodules and were treated by microspot CO₂ laser excision or by conventional microdissection. Video stroboscopic evaluation of vocal folds edges and mucosal waves showed significant improvements from preoperative and postoperative assessment in both groups. In addition, the symmetrical phase had the same trends¹¹. In this study, preoperative and

postoperative perceptual voice analysis was done by one rater using the GRBAS scale. During second postoperative assessment, there was no statistically significant difference between both groups regarding their quality of voice parameters (GRBAS; P value >0.05) Zhang et al compared between CO₂ laser and conventional methods in management of vocal fold polyps, the evaluation of voice outcome by GRBAS scale showed no significant difference between both techniques after 3 months follow up⁴.

Divakaran et al used GRBAS scale to evaluate the voice of patients of benign vocal fold lesions after CO₂ laser, which was treated by super pulsed mode at 6 W power. They followed up the patients at 2, 6 weeks and 3 months after surgery. There was a significant improvement in the GRBAS scale, they found that preoperative median of GRBAS score was 9, which improved to 6 after 2 weeks and reached score of 2 after 3 months of surgery¹⁴. In this study, there is a statistically significant difference between both groups regarding the operative time and bleeding in favor of laser technique. The mean duration of laser technique (4.9 ± 1.2 minutes) was less than the conventional technique time (13.4 ± 2 minutes), also mean of operative bleeding of laser technique (zero pack) is less than the conventional one (1.7 packs).

Motta et al mentioned that the value of the CO₂ laser comes from giving better operative hemostasis and no direct tissue contact of the instrument is necessary for resection, improving the view of the operative field giving better working conditions for the surgeon¹⁵. There are many factors that detect the thermal effects of the laser on tissue, one of them is the physical energy of the chosen laser beam, also water content and tissue vascularity. In general, the use of laser with 5-10 W of power, pulse duration of 0.01-0.05 seconds and a micro spot of 250 μm at 400mm

focal length is preferred to minimize thermal side effects¹⁴. However, the definite adjustment of laser should be selected according to the practical needs of the surgeon, e.g., higher energy and shorter focus for cutting and lower energy and longer focus for coagulation¹⁶. The CO₂ laser has become the best choice for most microlaryngeal surgery with the value of better microscopic control and less postoperative edema¹⁷. Finally, this study ensures that there is no significant difference in voice outcome of both techniques during the second postoperative assessment, this is matched with other studies like Benninger who conducted another randomized, prospective trial comparing micro spot CO₂ laser excision with a spot size of fewer than 250 mm and microdissection in the removal of vocal fold benign lesions like polyps, nodules, and cysts. He found no difference in clinical outcomes when comparing microdissection with laser excision of these lesions¹¹. This is unmatched with previous studies which stated that conventional microlaryngeal surgery was better. Abitbol et al conducted a study of laser versus conventional microlaryngeal surgery for the management of benign lesions. In their study, 40 patients with different benign lesions have undergone micro laryngeal surgeries for the removal of their lesions, 20 patients by CO₂ laser and the other 20 patients by conventional microlaryngeal surgery. Prior to surgery and 2 weeks after it, the patients were examined by videostroboscopy, assessment of the degree of dysphonia was done by auditory perceptual assessment (APA) and acoustic voice analysis. They demonstrated that the postoperative examination of all cases operated upon by laser showed congestion of both vocal folds lateral to the free edge as well as a decrease in the stroboscopic wave amplitude. On the other hand, in cases operated upon by conventional microlaryngeal surgery, there was slight

congestion of both vocal folds and the stroboscopic waves returned to normal in most cases (18 out of 20). The difference between pre and postoperative values of the four acoustic parameters in the two groups were compared together and showed insignificant difference in all the parameters except the shimmer percentage, which was better in the conventional microlaryngeal surgery group, so they concluded that expert surgeon is recommended as vocal fold structures are extremely delicate and to avoid tissue trauma, which could be best offered by conventional microlaryngeal surgery and should be completed by behavior modification (voice therapy) to reach optimal results of voice function¹⁹. The difference between the results of our study and Abitbol et al results may be due to the duration of postoperative follow-up, as their postoperative follow-up was after 2 weeks, but in our study, the final postoperative assessment was done after 3 months.

Conclusion:

In this study, there is no significant difference between both groups in all parameters except operative time and bleeding, as laser technique has less time and clear field.

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