

# Coblation Assisted Kashima Surgery: A Cross Sectional Study

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Original  
Article

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## ABSTRACT

**Background:** Managing individuals with bilateral vocal fold abductor paralysis is difficult and frequently requires surgery. It necessitates a delicate balance between airway and phonation. In this article, we discuss our experience with coblation in posterior cordotomy to treat patients with bilateral abductor paralysis (Coblation assisted Kashima Surgery).

**Patients and Methods:** A prospective study was done among 27 patients with bilateral vocal fold paralysis who underwent coblation assisted Kashima surgery at our tertiary care hospital. The handicap index and dyspnoeic scores were assessed before and after surgery. All patients were tracheostomised and after successful Kashima surgery, the tracheostoma was closed. Patients were followed up for a period of 3 months for worsening of voice/ dyspnoea/ aspiration.

**Results:** Of the 27 patients, 19 were males and 8 were females, most common aetiology of the vocal cord palsy was subsequent to thyroid surgery (Total thyroidectomy). The study showed that there was a significant mean difference between pre and post-tests among patients with dyspnoea index with  $P$ -value  $< 0.05$  i.e., 0.02. It also showed that there was significant mean difference between pre and post-tests among patients with VHI Index with  $P$ -value  $< 0.05$  i.e., 0.04.

**Conclusion:** Kashima operation gives good results with respect to airway improvement. Voice outcomes vary from patient to patient, however overall patient satisfaction with respect to voice was good.

**Key Words:** Bilateral abductor paralysis, Kashima surgery, Vocal cord Paralysis.

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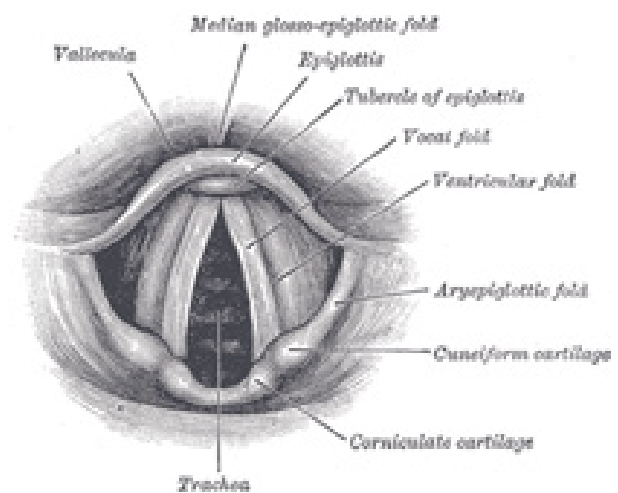
## INTRODUCTION

Bilateral vocal fold immobility is fairly common and may occur when there is damage to both the recurrent laryngeal nerves usually after thyroid surgery, extra-laryngeal malignancies, neurological disorders, nonsurgical trauma etc. Majority of these patients have a normal voice. They commonly present with respiratory distress due to airway compromise. The amount of glottic chink, kind of physical activity, body mass of arytenoids, and presence of any comorbidities determine occurrence and severity of this dyspnoea.

Tracheostomy is considered as the gold standard in the management of bilateral abductor vocal fold paralysis since a long time, giving great airway as well as good voice. However, the social stigma of having a tube in one's neck may lead to a low quality of life. As a result, the concept of enhancing the airway without a tracheostomy gave rise to a variety of surgical methods. There were attempts to make extra room at the glottis level or to rebuild nerve function.

Kashima pioneered the most effective lateralization surgery, endoscopic laser posterior cordotomy, in 1989.

This operation involves cutting the vocal fold transversely immediately in front of the vocal process. In addition, a small bit of false cord is eliminated. Tissue resection is continued laterally up to the inner perichondrium of the cricoid and the thyroid cartilage.



**Fig. 1:** Anatomy of Vocal Cord

Causes of Bilateral Vocal Cord Paralysis<sup>[2,3]</sup> (Table 1)

- Surgical (usually post thyroidectomy) - up to 59 % according to some studies.
- Mechanical - Intubation - approximately 25 %
- Trauma 2 %

- Neurological disorders – approximately 15 %
- Extra laryngeal malignancies - 5-17 %
- Inflammatory
- Radiation injury
- Toxins

**Table 1:** causes of vocal cord paralysis

<p><b>ACUTE COMPLICATIONS OF INTUBATION</b></p> <ul style="list-style-type: none"> <li>• ARYTENOID DISLOCATION</li> <li>• ANTERIOR DISLOCATION OF THYROID RELATIVE TO CRICOID → REC. LARYNGEAL N. INJURY</li> <li>• HYPEREXTENSION OF NECK → STRETCHING VAGUS N.</li> <li>• LARYNGEAL MASK AIRWAY</li> <li>• EXCESSIVE CUFF PRESSURE → REC. LARYNGEAL N. INJURY</li> </ul>	<p><b>CHRONIC COMPLICATIONS OF INTUBATION</b></p> <ul style="list-style-type: none"> <li>• EXCESSIVE CUFF PRESSURE → REC. LARYNGEAL N. INJURY</li> <li>• POST GLOTTIC STENOSIS → PROLONGED / TRAUMATIC INTUBATION</li> <li>• STENT PLACEMENT IN PROXIMAL ESOPHAGUS</li> </ul>	<p><b>INFLAMMATORY CAUSES OF CRICOARYTENOID JOINT</b></p> <ul style="list-style-type: none"> <li>• MUMPS</li> <li>• RHEUMATOID ARTHRITIS</li> <li>• GOUT</li> <li>• ANKYLOSING SPONDYLITIS</li> <li>• REITER SYNDROME</li> <li>• SLE</li> <li>• CROHN'S DISEASE</li> </ul>
<p><b>SURGICAL CAUSES</b></p> <ul style="list-style-type: none"> <li>• THYROID SURGERY</li> <li>• PARATHYROID SURGERY</li> <li>• ESOPHAGEAL SURGERY</li> <li>• TRACHEAL SURGERY</li> <li>• BRAIN STEM SURGERY</li> <li>• ANTERIOR APPROACH TO CERVICAL TRUNK</li> </ul>	<p><b>NEUROLOGICAL CAUSES</b></p> <ul style="list-style-type: none"> <li>• ARNOLD CHIARI MALFORMATION</li> <li>• DIABETES MELLITUS</li> <li>• MENINGOMYELOCELE</li> <li>• AMYOTROPHIC LATERAL SCLEROSIS</li> <li>• MYASTHENIA GRAVIS</li> <li>• HYDROCEPHALUS</li> </ul>	<p><b>RADIATION CAUSES</b></p> <ul style="list-style-type: none"> <li>• RADIATION THERAPY</li> <li>• POST RADIATION FIBROSIS OF CRICOARYTENOID, VOVAL FOLDS OR BOTH</li> <li>• CHONDRONECROSIS</li> </ul>

**Clinical Features of Bilateral Abductor Paralysis of Vocal Cords<sup>[1]</sup>**

Patients with BVFP usually have complaints related to airway, voice, and swallowing, which may be acute, subacute, or chronic depending on aetiology. Patients generally come with stridor, which is an indication of airway difficulties. When the vocal cords are too widely apart, the voice will be breathy at first. Over time, the vocal cords may medialize, resulting in a near-normal voice and patients. Dyspnoea may be varying depending on the amount of glottic chink, presence / absence of comorbidity, arytenoid body mass and physical activity. The symptom complex may or may not include aspiration and dysphagia. 10% of these patients may need no intervention.

**PATIENTS AND METHODS:**

This cross-sectional study was done over a period of three years (June 2019 to June 2021) in the ENT department of Sree Balaji Medical College and Hospital, Chennai. The study was aimed at exploring the outcome of treating BVFP with coblation assisted Kashima's surgery, in terms of effectiveness and safety among 27 patients of either sex, in the age group of 20 - 70 years who came to the Department of ENT with complaints of respiratory discomfort secondary to bilateral abductor vocal fold paralysis. The patients were subjected to a thorough ENT examination and general physical examination. Associated systemic illness was recorded. Patients with vocal cord paralysis were further examined with x-ray-chest, x-ray-neck, computed tomography scans (up to aortic arch on

the left and skull base to thoracic inlet on the right), and video laryngoscopy. Chest/medical specialists examined the patients to identify the cause of palsy. Vocal cords in the paramedian position were seen on video laryngoscopic examination. Preoperative and post-operative voice analyses using subjective parameter in the form of Voice Handicap Index (VHI) were done on selected patients. The severity of dyspnoea was recorded according to Dyspnoea Index<sup>[19]</sup> pre-operatively and postoperatively.

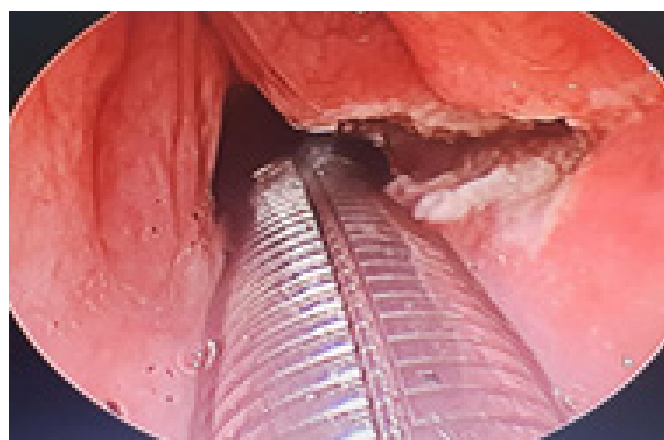
The selected patients who underwent surgery were first tracheostomised. The surgery was performed under general anaesthesia which was administered via the tracheostomy. A Kleinsasser suspension laryngoscope was inserted and the larynx was examined under endoscope. A probe was used to assess the mobility of the cricoarytenoid joint. Though Kashima and Dennis<sup>[12]</sup> employed CO<sub>2</sub> LASER for the surgery, we employed coblation technology<sup>[4]</sup> at our centre (Fig. 4). The PROcise®MLW Plasma Wand was employed, which combines ablation, resection, soft tissue coagulation, irrigation, and suction capabilities into a versatile single-use device.<sup>[3]</sup> It operates by using radiofrequency energy via a conductive solution mode; when enough energy is supplied, the conductive solution is transformed into a plasma layer comprising charged particles. When these particles come into touch with tissues, they produce molecular dissociation, which causes tissue disintegration. As there is relatively low treatment site temperature

(40-700 C), it results in reduced collateral tissue damage. For the procedure, we must use the more medially situated cord. If both cords are in identical positions, we must choose the one with at least a slight bit of movement. If both cords are equally mobile and in equivalent position, then the surgeon must pick the side with better access. Then, 1mm incision was made in front of the arytenoid vocal process, and a 3.5-4 mm C-shaped section of the posterior 1/3<sup>rd</sup> of the vocal cord was ablated from the free border of the membranous cord, reaching 4mm laterally over the ventricular band. The vocal process was not exposed. The anterior two-thirds of the vocal cord was preserved (Fig. 2). Post operatively, in addition to antibiotics, patients were given antireflux medication for up to 8 weeks after surgery. On POD 2, Shiley's tracheostomy tube was spigotted: first during the day for two days, followed by a complete 24-hour period (Fig. 3). With proper exercise tolerance, all patients tolerated spigotting. Their tubes were withdrawn 1 week after surgery, and their wounds were approximated and plastered.

Patients were followed up for upto 3 months after surgery.

#### ***Complications of surgery<sup>5,13]</sup>***

The most common complications seen are scar formation, granuloma formation, posterior glottic web and postoperative oedema.



**Fig. 2:** Case 1 Intraop Kashima's Posterior Cordotomy using Coblation



**Fig. 3:** Case 1 Tracheostomy Decannulation After 1 Week of Surgery



Fig. 4: Case 2 Intraop Kashima's Posterior Cordotomy using Coblation



Fig. 5: Case 2 Tracheostomy Decanulation 1 Week after Surgery

**RESULTS:**

• This study consisted of 27 patients, of which 9 were males (33.33%) and 18 were females (66.66%), in the age group of 20-70 yrs (Fig. 6).

• The mean age of patients who participated in the study was 40.7. Among all the patients who participated in the study, maximum number of 9 females were in the 40 - 50 age group. Whereas, in the 20-30 age group, the number of males was found to be more than that of females (Fig. 7).

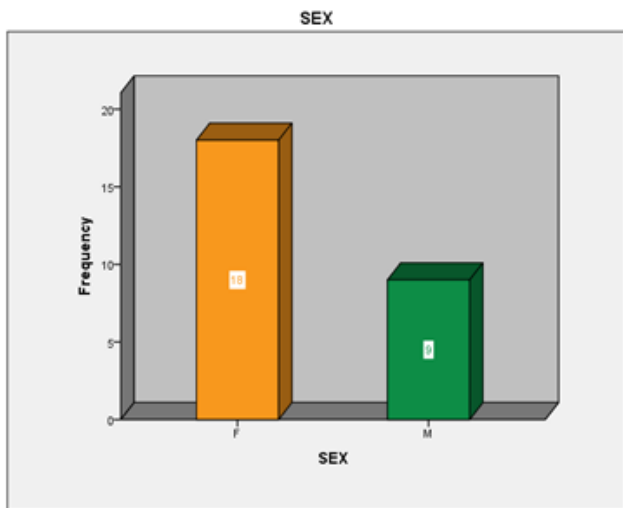


Fig. 6: sex distribution in patients with vocal cord paralysis

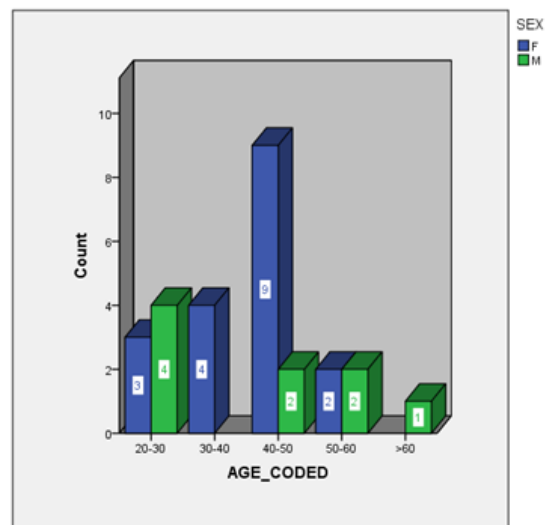
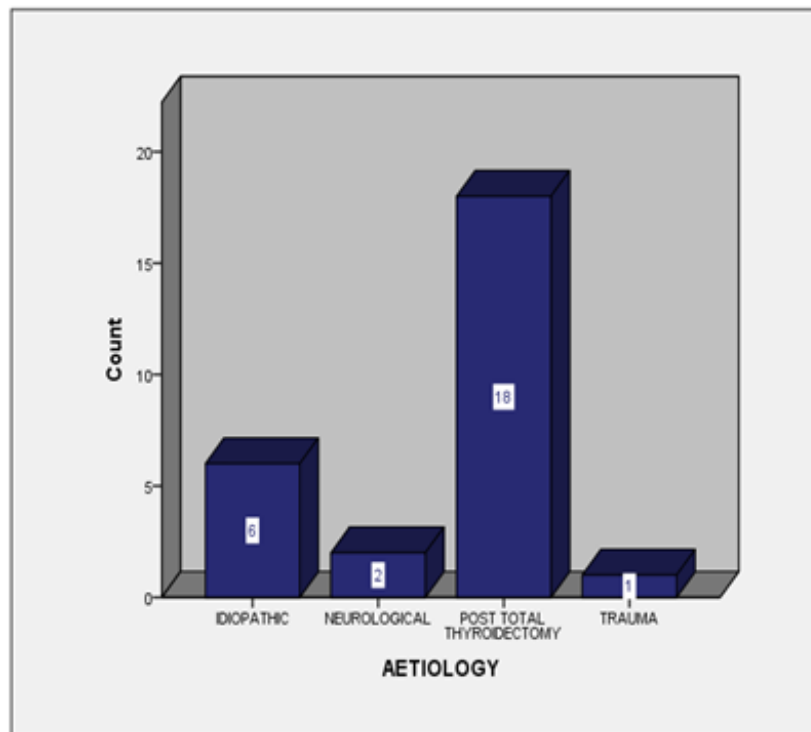


Fig. 7: age - sex distribution in patients with vocal cord paralysis

• In our study, the most common aetiology was found to be surgical - post total thyroidectomy (66.66%), which was seen mostly among female patients in the 40- 50 age group. The second most common cause was idiopathic

seen in 22.22 % patients. Very few patients in our study were found to have BVFP due to neurological conditions (7.4%) and following trauma (3.7%) (Fig. 8).



**Fig. 8:** aetiology of patients with vocal cord paralysis

**Table 2:** aetiology of vocal cord paralysis

		Aetiology			
Age_Coded	SEX		Frequency	Percent	
20-30	F	Valid	Idiopathic	3	100.0
			Idiopathic	2	50.0
	M	Valid	Neurological	1	25.0
			Trauma	1	25.0
			Total	4	100.0
30-40	F	Valid	Idiopathic	1	25.0
			Post Total Thyroidectomy	3	75.0
40-50	F	Valid	Total	4	100.0
			Post Total Thyroidectomy	9	100.0
			Post Total Thyroidectomy	2	100.0
50-60	F	Valid	Post Total Thyroidectomy	2	100.0
			Neurological	1	50.0
			Post Total Thyroidectomy	1	50.0
>60	F	Valid	Total	2	100.0
			Post Total Thyroidectomy	1	100.0

- Postoperative complications developed in very few patients: Granulation (7.4%) and aspiration (3.7%) (Fig. 9).

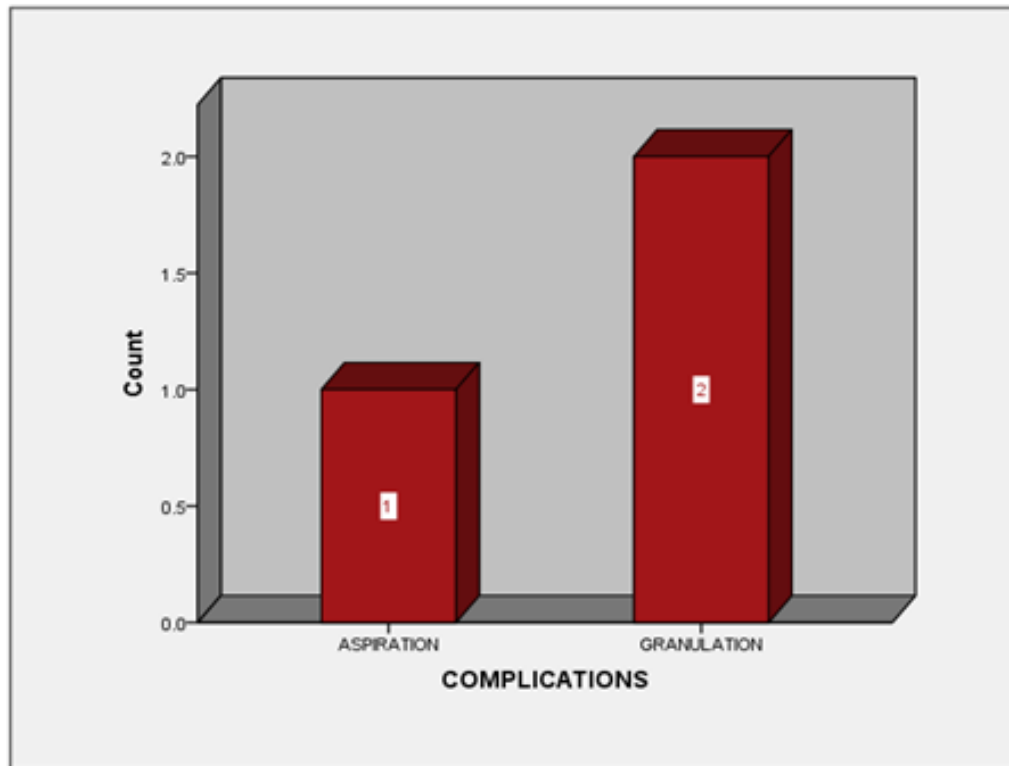


Fig. 9: post operative complication in patients with vocal cord paralysis

- As the data was not normally distributed, non - parametric test was applied. From our study we found that there was a significant mean difference between pre and post-tests among the patients

with dyspnoeic index with  $P\text{-value} < 0.05$  i.e., 0.02 and VHI with  $P\text{-value} < 0.05$  i.e., 0.04 (Table 3).

Table 3: wilcoxon signed ranks test

	Statistics			
	Dyspnoea Index - Preop	Dyspnoea Index Postop	VHI Preop	VHI Postop
Mean	27.67	20.30	60.19	64.19
Std. Deviation	3.340	2.539	7.169	8.775
<i>P-Value</i>	0.02		0.04	

Wilcoxon Signed Ranks Test

Table 4: npar tests

	Descriptive Statistics				
	Minimum	Maximum	25 <sup>th</sup>	50 <sup>th</sup> (Median)	75 <sup>th</sup>
Dyspnoea Index - Preop	19	33	25.00	27.00	30.00
VHI Preop	46	72	56.00	58.00	69.00
Dyspnoea Index Postop	15	27	19.00	20.00	22.00
VHI Postop	46	81	58.00	63.00	69.00

NPAR Tests

Table 5: duration of hospital stay

	Statistics	
	Duration of Hospital Stay	Age
Mean	8.26	40.70
Std. Deviation	1.873	11.296

- Mean hospital stay was around 8.26 days.



## DISCUSSION

The study was aimed at exploring the outcome of treating BVFP with coblation assisted Kashima's surgery, in terms of effectiveness and safety. In patients where vocal cord palsy was due to axonotmesis, in whom neuroregeneration occurs at a rate of 1 to 3 mm/day, spontaneous recovery occurs.

In our study, the most common aetiology was found to be surgical - post total thyroidectomy (66.66%), which was seen mostly among female patients in the 40-50 age group as thyroid malignancies are more common in female patients. In a similar study done by Dr. Tabish Maqbool, it was found that "majority of the patients were females (75%) and the major aetiology was seen to be thyroid surgery (83.3%)."<sup>[6]</sup> Francesco Dispenza *et al.* in their study described that "73.3% of patients were females and thyroid surgery was the aetiology in 100% of the patients."<sup>[7]</sup> This was found to be similar to the findings of our study. Our study showed that postoperative complications developed in very few patients: Granulation (7.4%) and aspiration (3.7%). According to Hans Edmund Eckel "subclinical aspiration occurred in 5 of 10 patients after arytenoidectomy."<sup>[8]</sup> However very few patients developed postoperative complications like aspiration in our study as we did only cordectomy for patients in our study. When regaining of vocal cord mobility is doubtful or impossible, ablative treatments, such as vocal cordotomy with or without medial partial arytenoidectomy to increase the glottic airway, may be considered. Current endoscopic procedures often use laser technology to achieve the cordotomy and to some extent ablate the medial side of the arytenoid. These techniques, which aim to achieve a balance between widening the airway and retaining voice, are frequently well tolerated.<sup>[11]</sup> Although lasers can be a helpful tool for many treatments, they can cause intraoperative bleeding and postoperative granulation tissue and collateral heat injury. There is a potential to use technology that reduces surgical time and limits heat-related collateral soft tissue injury. "Raghavendra Rao in his study of 25 patients divided them into 2 groups. Group 1 underwent vocal cord lateralization (15 patients) while group 2 (10 patients) underwent posterior cordotomy. They saw that 100% of patients in group 2 had grade 0 postoperative airway compared to 76.9% in group 1. 80% of group 2 patients had good postoperative subjective voice quality compared to only 23% of group 1 patients."<sup>[9]</sup> The study done by Dr. Tabish Maqbool proved that "arytenoidectomy and VC lateralization were not superior to posterior cordotomy."<sup>[6]</sup> Our study also shows similar results, as complications encountered were less. Dr. Tabish Maqbool in their study found that "five patients (66.7%) had a normal MPT, two patients (33.3%) had a

reduced MPT". In his study, VHI values demonstrated that nine patients (75%) had no/mild degree of voice handicap, two patients (16.6%) had moderate and one patient (8.33%) had a severe degree of handicap. He also described that those 11 patients (91.6%) had a normal MPT (above 10), one patient (8.33%) had a reduced MPT (10 or below). In his study which was based on dyspnoea index score, the difference in the preoperative and postoperative mean was 9.3 and the *p value* was 0.001 which was statistically significant.<sup>[6]</sup> We have used Dyspnoea Index Score to evaluate the surgical outcome for effect on respiration. In our study it was shown that there was a significant mean difference between pre and post-test among patients with Dyspnoea Index with *p-value* < 0.05 i.e., 0.02. It also showed that there was significant mean difference between pre and post-test among patients with VHI Index with *p-value* < 0.05 i.e., 0.04. Eckel *et al.* "compared the results between posterior cordotomy and complete arytenoidectomy and found that subclinical aspiration was seen more in patients treated with complete arytenoidectomy,"<sup>[10]</sup> since our study showed very few cases with postoperative aspiration. Even though the voice improvement could not be appreciated by patients in the immediate postoperative period, a few weeks later they showed significant improvement. Patients showed significant improvement in breathing in the immediate postoperative period. Hence, we can conclude that coblation assisted posterior cordotomy (Kashima's Surgery) is better effective as it shows better results and fewer postoperative complications.

## CONCLUSION

From south India, our study is one of a kind and has been done in an urban tertiary health care set up; this study is an innovation of the often performed laser-assisted Kashima procedure. Coblation being a less expensive device than laser is more affordable for patients and institutions – thus making it accessible to more patients in a private health care setup. Our study also has a fairly larger sample size as compared to other studies of this nature.

There are several surgical treatments for treating bilateral vocal fold abductor paralysis, each with its own set of benefits and drawbacks. Posterior cordectomy is a well-known therapy option for this problem. The use of a coblator in this procedure produces excellent outcomes with minimum surrounding tissue injury, resulting in early decannulation. Significant improvement of voice and breathlessness was noted in all patients. This procedure restores sufficient glottic space, without damaging the phonation and sphincteric functions of larynx. Early decannulation also gave patients better quality of life. Most other studies have used a laser assisted Kashima's surgery, but we have used the coblation method of Kashima's

surgery proved to be far more superior as we encountered fewer postoperative complications and postoperative recovery was better.

### CONFLICT OF INTEREST

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There are no conflicts of interest.

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