DOI: 10.7860/JCDR/2023/66953.18665

Original Article

Ear, Nose and Throat Section

Application of Coblation for Airway Disorder Management in ENT Practice: A Prospective Cohort Study

POOJA SHRIWASTAV[1], HETAL MARFATIA[2], ANOUSHKA SAHAI[3], ASHWINI KUMAR GAIKWAD[4], MONANKITA SHARMA[5]

ABSTRACT

Introduction: Coblation, a form of radiofrequency surgery, involves using radiofrequency energy to create a plasma field through a conductive medium. This technique dissociates the medium into high-energy ions that break intercellular bonds, leading to tissue dissociation. Coblation is performed at low temperatures, making it less painful and conducive to healing in airway surgeries.

Aim: To evaluate the indications, advantages, and outcomes of coblation-assisted airway surgeries.

Materials and Methods: A prospective cohort study was conducted from November 2019 to May 2021 at the Department of Ear, Nose and Throat (ENT), Seth GS Medical College and KEM Hospital, Mumbai, Maharashtra, India. Patients with breathing difficulties, voice changes, or airway obstruction symptoms were included. A detailed history, physical examination, and diagnostic procedures were carried out. Coblation was employed under general anaesthesia for laryngeal or tracheal pathology. Data on intraoperative findings, blood loss, hospital stay, and postoperative improvements were recorded in a worksheet-based program, Numbers version 13.1 for macOS. Deductions based on the data were presented using bar charts and diagrams. Continuous variables were summarised using summary statistics, while categorical values were estimated using frequencies and percentages.

Results: A total of 15 patients underwent coblation-assisted surgeries. Breathlessness was the most common symptom 11 (73.33%), followed by stridor in 10 (66.67%) and decreased oxygen levels in 8 (53.3%) were observed. Indirect laryngoscopy showed no findings compared to 70-degree scopy in detecting subglottic stenosis. Intraoperatively, 40% had Grade-II, and 27% had Grade-III subglottic stenosis. The average postoperative stay was five days. At one month, 73% showed improvement, particularly those with subglottic stenosis, while no improvement was seen in 27% of cases.

Conclusion: Coblation-assisted airway surgeries offer benefits like minimal collateral damage and reduced blood loss. In this study, 73% of patients showed improvement, suggesting coblation's potential advantages over other modalities. Although cost remains a concern, coblation's ability to reduce postoperative morbidity and improve healing time makes it a promising tool in airway surgeries.

Keywords: Airways, Angiofibroma, Endoscopy, Haemostasis, Laryngostenosis, Papillomatosis, Radiofrequency

INTRODUCTION

Coblation (Controlled Ablation) technology has emerged as a revolutionary tool in the field of airway surgeries within ENT medicine, revolutionising the way delicate procedures are performed with enhanced precision and minimal tissue damage [1]. This innovative technique harnesses the principles of controlled plasma-mediated ablation, offering a superior alternative to traditional methods.

At the heart of coblation technology lies its intricate mechanism, which involves the application of radiofrequency energy to a conductive medium, often a saline solution. The energy excites the ions within the medium, forming a precisely controlled plasma field due to the dissociation of saline into high-energy ions (sodium and chloride ions). This plasma, while maintaining a relatively low temperature (between 60°C and 70°C), efficiently breaks down tissue on a molecular level. As a result, tissue is gently disintegrated without the undesirable collateral damage associated with high-temperature cautery techniques. This finely tuned process ensures that surrounding healthy tissue remains largely unaffected, leading to reduced postoperative pain, faster recovery times, and improved patient outcomes [2].

The most compelling benefit of coblation is its ability to operate at lower temperatures, thereby mitigating the risks of thermal injury to adjacent tissues. This translates to reduced scarring, less disruption of delicate structures, and minimised complications during airway surgeries. Moreover, the precision of coblation technology allows for intricate procedures in challenging anatomical areas, such as the vocal cords, trachea, nasal passages, tonsils, and adenoids, where the preservation of healthy tissue is paramount for optimal functionality [3].

The present study was conducted at the tertiary care centre to evaluate the indications, advantages, and outcomes of coblation-assisted airway surgeries. During the course of the study, the importance of thorough clinical and radiological evaluations was highlighted to accurately diagnose various airway pathologies presenting at the centre.

MATERIALS AND METHODS

A single-centre prospective cohort study was conducted at the Department of ENT of Seth GS Medical College and KEM Hospital, Mumbai, Maharashtra, India from November 2019 to May 2021. The study was conducted in accordance with ethical standards and received approval from the Institutional Ethics Committee (IEC) (IEC(II)/OUT/679/2020) on December 31, 2020, for project number EC/141/2019. Consents were obtained from the patients using the approved format provided by the ethics committee.

Inclusion criteria: Patients who presented to the ENT-Outpatient Department (OPD) with symptoms indicating airway pathology. These symptoms included stridor, breathlessness, fall in oxygen saturation, changes in voice, nasal obstruction, and other miscellaneous symptoms.

Exclusion criteria: Patients with tonsillar-adenoid hypertrophy or those deemed unfit for surgery were excluded from the study.

Due to the COVID-19 pandemic and the resulting lockdown in India, the number of elective procedures performed was significantly

reduced as our hospital served as a COVID-19 care centre. Additionally, the lack of public transportation during the lockdown prevented patients from seeking medical care. Therefore, the study included patients who presented to the department during the pandemic after proper screening for COVID-19 infection.

Before surgery, a detailed history of presenting complaints, present illness, past medical history, and personal history was recorded. Special attention was given to rule out any previous surgeries or past traumas. Physical examinations were conducted, including anterior rhinoscopy, diagnostic nasal endoscopy, indirect laryngoscopy, and 70-degree scopy. All patients underwent Computed Tomography (CT) scans from the skull base to the mediastinum with contrast, including the paranasal sinuses, to assess the level of obstruction before planning for surgery.

Patients with tracheal/laryngeal stenosis were graded preoperatively based on severity and compared with postoperative grading. The Cotton-Myer grading system was used for the paediatric age group, with Grade 1 indicating 0-50% obstruction, Grade 2 indicating 51-70% obstruction, Grade 3 indicating 71-99% obstruction, and Grade 4 indicating no detectable lumen [4].

The McCaffery classification was utilised for grading laryngotracheal stenosis in adults based on the subsites and length of the stenosis. Stage 1 encompassed subglottic or tracheal lesions less than 1 cm in length, Stage 2 involved subglottic lesions longer than 1 cm without tracheal involvement, Stage 3 included subglottic lesions with tracheal involvement but not affecting the glottis, and Stage 4 consisted of subglottic, tracheal, and glottic lesions with fixed vocal cords [5].

Patients received counseling regarding the nature of the disease, available treatment options, benefits and limitations of surgery, postoperative care, postoperative medical treatment, and the potential for success or complications. Prior to surgery, all patients were started on prophylactic broad-spectrum antibiotics (amoxicillin-clavulanic acid) with the dosage adjusted based on their weight. Patients with laryngotracheal pathologies underwent preoperative nebulisation with budesonide. In cases of Juvenile Nasopharyngeal Angiofibroma (JNAF), preoperative embolisation was performed to reduce tumour vascularity. The goal of these interventions was to minimise airway secretions, oedema, and facilitate bronchodilation in lower airway procedures. Nebulisation using budecort and levosalbutamol was administered. For upper airway procedures, nasal decongestion was achieved by applying a patty dipped in a solution of 4% lignocaine plus 4cc adrenaline.

In cases of laryngeal or tracheal pathology, the procedure was performed under general anaesthesia with the patient in a supine position. Orotracheal intubation or intermittent apnoea was used for tracheal pathology. The patient was placed in Boyce's position, and a micro-laryngoscope with chest suspension was used to open their mouth wide [6]. After positioning the direct laryngoscope, the laryngeal lesions or tracheal pathology were fully visualised, and the micro-laryngoscope tube was pushed posteriorly.

The Laryngeal Coblation Wand was then introduced transorally, set to 5 for coblation and 3 for coagulation. Saline irrigation and a suction apparatus were connected via tubing. The tissue was gently coblated and separated from the laryngeal lesions using the coblator. A laser endotracheal tube was unnecessary since the risk of fire was not present. The base of the laryngeal lesion was completely coblated, ensuring no gross remnant lesions remained. Any bleeding points were immediately cauterised, with minimal damage to the adjacent healthy mucosa.

For nasal pathology, coblation system for sinonasal tumours were utilised. The mass was dissected using the coblator wand and removed in its entirety. Any bleeding points were cauterised using the coagulation mode. Hemostasis was achieved with minimal blood loss.

Postoperatively, patients with laryngotracheal stenosis who underwent coblation-assisted surgery were admitted to the postoperative ward. They were given a course of steroids and antibiotics (dexamethasone in tapering doses and broad-spectrum antibiotics, such as amoxicillin-clavulanic acid, as per departmental protocol) to prevent postoperative oedema and infection. Patients who underwent glottic procedures were advised complete voice rest for 10 days to facilitate proper wound healing. In the case of nasopharyngeal mass removal, nasal packs were removed on postoperative day 2.

All patients were followed-up at intervals of one month, three months, and six months after surgery for assessment. Assessment included findings from the 70-degree examination and airway assessment under general anaesthesia for laryngotracheal pathologies. Stenosis grade was determined in cases of stenosis. For nasal and palatal pathologies, endoscopy was performed to check for recurrence or new pathology.

STATISTICAL ANALYSIS

All the data obtained were recorded in a predesigned case record form. The data obtained from all patient case records were entered into a worksheet-based program, specifically Numbers version 13.1 for macOS. Relevant deductions based on the data were presented using bar charts and diagrams. Summary statistics were used to summarise continuous variables, while frequencies and percentages were calculated for categorical values.

RESULTS

The present study included 15 cases in which coblation-assisted surgery was performed, out of which 9 (60%) were males and 6 (40%) were females.

Among the 15 patients, breathlessness was the most prevalent symptom 11 (73.3%), followed closely by stridor 10 (66.67%). Nasal obstruction and miscellaneous symptoms, including epistaxis and oral mass, were less common, each affecting 6.67% of the patients [Table/Fig-1,2].

Age (years)	n (%)
0-10	3 (20)
11-20	3 (20)
21-30	2 (13)
31-40	4 (27)
41-50	2 (13)
51-60	1 (7)

[Table/Fig-1]: Age distribution of study participants (n=15).

Symptoms	n (%)
Breathlessness	11 (73.3)
Stridor	10 (66.67)
Fall in oxygen saturation	8 (53.3)
Change in voice	2 (13.3)
Nasal obstruction	1 (6.67)
Miscellaneous	
Epistaxis	1 (6.67)
Oral mass	1 (6.67)

[Table/Fig-2]: Frequency of symptoms.

In the present study, indirect laryngoscopy and 70-degree scopy were conducted in all patients, except for the patient with a palatal cyst where it was not possible due to complete obstruction of the oral cavity and oropharynx. Out of 14 patients [Table/Fig-3], vocal cord in a paramedian position and polypoidal masses on the anterior commissure were each identified in one patient through indirect laryngoscopy and the 70-degree examination. Glottic stenosis was found in two patients using both methods. Subglottic stenosis was

exclusively detected in four (28.57%) patients via the 70-degree examination. In the majority of cases, no significant findings were observed, with 10 patients identified through indirect laryngoscopy and six through the 70-degree examination.

Clinical findings (n=14)*	Number of patients where clinical finding was identified on indirect laryngoscopy	Number of patients where clinical finding was identified on 70 degree scopy
Vocal cord in paramedian position	1 (7.14%)	1 (7.14%)
Polypoidal masses on anterior commissure	1 (7.14%)	1 (7.14%)
Glottic stenosis	2 (14.28%)	2 (14.28%)
Subglottic stenosis	none	4 (28.57%)
No significant finding	10 (71.42%)	6 (42.85%)

[Table/Fig-3]: Comparison between indirect laryngoscopy and 70-degree findings in patients.
*Indirect laryngoscopy or 70 degree scopy was not possible in the patient of palatal cyst

The aetiologies identified in the study were classified based on anatomical site into the laryngo-tracheal region, nasopharyngeal and sinuses, and oral and oropharyngeal region [Table/Fig-4].

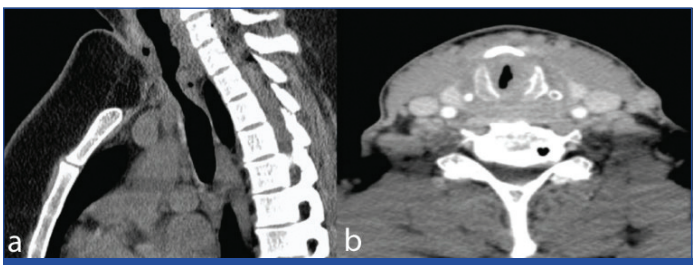
Anatomical site	Aetiology	Percentage (%)
Laryngo-tracheal region	Subglottic stenosis	8 (53.33)
	Glottic stenosis	2 (13.33)
	Granulations over the posterior wall of subglottis	1 (6.67)
	Small polypoidal mass over anterior commissure of vocal cord and in subglottis	1 (6.67)
	Bilateral abductor vocal cord palsy with minimal chink	1 (6.67)
Nasopharyngeal and sinuses	Juvenile Nasopharyngeal Angiofibroma (JNAF)	1 (6.67)
Oral and oropharyngeal	Palatal cyst	1 (6.67)

[Table/Fig-4]: Classification of the aetiologies identified in the present study.

In the present study, subglottic narrowing was observed in 8 (53.3%) cases on CT scan [Table/Fig-5,6]. Radiological investigation was not conducted for the patient with a palatal mass.

CT findings	n (%)
Subglottic narrowing	8 (53.3)
Glottic narrowing*	3 (20)
Mass over glottis	1 (6.67)
Nasopharyngeal mass extending into paranasal sinuses	1 (7)

[Table/Fig-5]: Aetiologies identified on CT scan in the present study.
*On CT scan, glottic stenosis and bilateral vocal cord palsy was reported as narrowed glottis

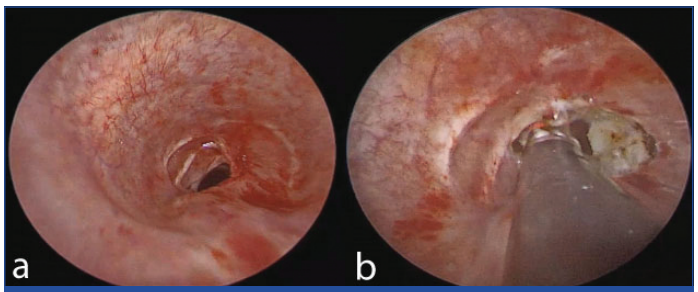


[Table/Fig-6]: CT scan skull base to mediastinum with contrast: (a) Sagittal section representing Grade-II subglottic stenosis; (b) Axial section representing Grade-II glottic stenosis.

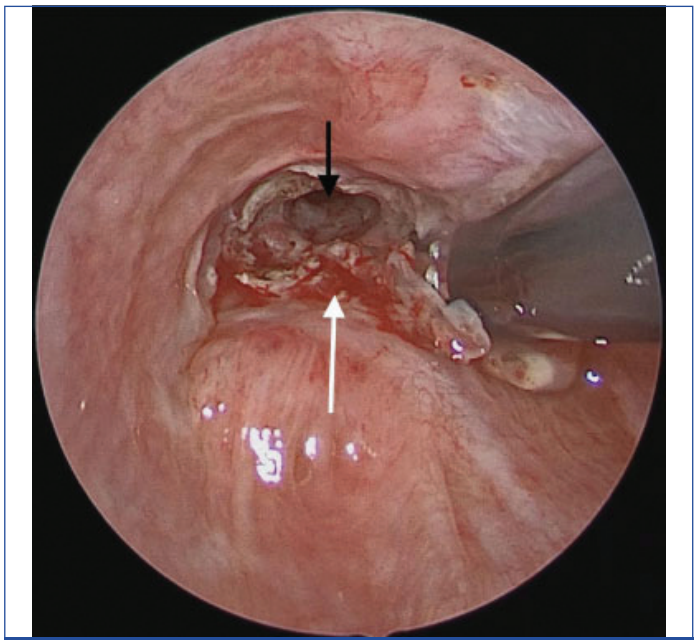
Among the 15 patients, the most common intraoperative finding [Table/Fig-7] was adult Grade-II subglottic stenosis (five patients) [Table/Fig-8], followed by adult Grade-III subglottic stenosis (two patients) and adult Grade-III glottic stenosis (two patients). Other findings included granulations [Table/Fig-9], small polypoidal masses (laryngeal papillomatosis), bilateral abductor vocal cord palsy with a minimal chink, a pinkish globular mass in the left nasal cavity [Table/Fig-10], and a large palatal mass in one patient each.

Intraoperative findings (n=15)	Number of patients
Paediatric Grade-II Subglottic stenosis**	1
Adult Grade-II Subglottic stenosis*	5
Adult Grade-III Subglottic stenosis*	2
Adult Grade-III Glottic stenosis*	2
Granulations over posterior wall of subglottis	1
Small polypoidal masses over anterior commissure of vocal cord and in subglottis (laryngeal papillomatosis)	1
Bilateral abductor vocal cord palsy with minimal chink	1
Pinkish globular mass in left nasal cavity	1
Large palatal mass	1

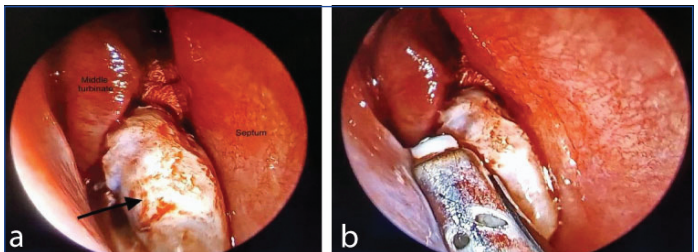
[Table/Fig-7]: Classification of intraoperative findings in the present study.
*McCaffery classification [5] for laryngotracheal stenosis used for adults (>18 years); **Cotton-Myer classification [4] for subglottic stenosis used for paediatric age group



[Table/Fig-8]: (a) Grade-II sub-glottic stenosis intraoperatively; (b) Endoscope assisted (intraoral) release of stenosis using coblation wand.



[Table/Fig-9]: Endoscope assisted posterior subglottic granulations (white arrow) removal using coblation. Black arrow representing the normal trachea underneath.



[Table/Fig-10]: (a) Endoscopic image of right-sided JNAF in a 14-year-old male child; (b) Coblation assisted removal of nasal mass (using Evac 70 coblator wand).

Intraoperative blood loss was less than 10 mL in 13 patients who underwent coblation-assisted surgeries for laryngotracheal pathologies. It was approximately 15 mL for the patient with palatal

mass excision and approximately 600 mL in the patient who underwent JNAF excision.

The majority of the patients (60%) in the present study had a hospital stay of approximately five days after coblation-assisted surgeries [Table/Fig-11].

No. of days	n (%)
4	2 (13)
5	9 (60)
6	3 (20)
7	1 (7)

[Table/Fig-11]: Hospital stay (n=15).

At the end of one month, five patients improved from Grade-II to Grade-I subglottic stenosis, followed by two patients who improved from Grade-III subglottic stenosis to Grade-II subglottic stenosis. No improvement was found in three patients, out of which two patients had Grade-III subglottic stenosis and one patient had Grade-II subglottic stenosis. One patient had minimal scar tissue over the posterior subglottis. The patient with laryngeal papillomatosis had minimal scarring in the subglottis in the postoperative period. The patient with bilateral vocal cord palsy showed no improvement on follow-up. The remaining two patients (patients with JNAF and palatal cyst) showed good results in the postoperative period. Postoperative changes seen in the first month remained almost the same at the end of the third and sixth months [Table/Fig-12].

The majority of the patients, showed improvement, while no improvement was noticed in 4 (27%) of the cases [Table/Fig-13].

Intraoperative findings (N=15)	Follow-up findings at one month	Follow-up findings at three months follow-up	Follow-up findings at six months follow-up
Grade-III subglottic stenosis (N=2)*	Grade-II subglottic stenosis* (N=2)	Grade-II subglottic stenosis* (N=2)	Grade-II subglottic stenosis* (N=2)
Grade-II subglottic stenosis (N=5)* Grade-II subglottic stenosis (N=1)**	Grade-I subglottic stenosis* (N=5)	Grade-I subglottic stenosis* (N=5)	Grade-I subglottic stenosis* (N=5)
	Grade-II subglottic stenosis** (N=1)	Grade-II subglottic stenosis** (N=1)	Grade-II subglottic stenosis** (N=1)
Grade-III Glottic stenosis (N=2)*	Grade-III Glottic stenosis (N=2)*	Grade-III Glottic stenosis (N=2)*	Grade-III Glottic stenosis (N=2)*
Granulations over posterior wall of subglottis (N=1)	Minimal scar tissue over posterior wall of subglottic (N=1)	Minimal scar tissue over posterior wall of subglottic (N=1)	Minimal scar tissue over posterior wall of subglottic (N=1)
Small polypoidal masses over anterior commissure of vocal cord and in subglottis (laryngeal papillomatosis) (N=1)	Glottis is normal with minimal scar tissue present in subglottis (N=1)	Glottis is normal with minimal scar tissue present in subglottis (N=1)	Glottis is normal with minimal scar tissue present in subglottis (N=1)
Bilateral abductor vocal cord palsy with minimal chink (N=1)	Bilateral vocal cord palsy with minimal chink (N=1)	Bilateral vocal cord palsy with minimal chink (N=1)	Bilateral vocal cord palsy with minimal chink (N=1)
Pinkish globular mass in left nasal cavity (N=1)	Postoperative fibrotic changes (N=1)	Postoperative fibrotic changes (N=1)	Postoperative fibrotic changes (N=1)
Large palatal mass (N=1)	Postoperative fibrotic changes (N=1)	Postoperative fibrotic changes (N=1)	Postoperative fibrotic changes (N=1)

[Table/Fig-12]: Comparison of intraoperative clinical findings with postoperative 1st, 3rd and 6th month follow-up visits.
*McCaffery classification [5] for laryngotracheal stenosis used for adults (>18 years); **Cotton-Myer classification [4] for subglottic stenosis used for paediatric age group

Observation (N=15)	n (%)
Improvement	11 (73)
No improvement	4 (27)

[Table/Fig-13]: Overall improvement of cases in the present study (based upon postoperative follow-up at 1, 3 and 6 months).

DISCUSSION

Airways refer to the passages through which air travels in and out of the respiratory system. They are divided into two main sections: the upper airways, which include the nose, mouth, pharynx, and larynx, and the lower airways, comprising the trachea beyond the carina, bronchi, and lungs. These divisions play a crucial role in maintaining proper airflow and filtering and conditioning the inhaled air [7].

The present study was conducted in the Department of ENT at a tertiary care hospital in Mumbai to highlight the importance of coblation in various airway procedures.

Study comprised 15 patients, with the majority (60%) being males and 40% being females. In the present study, the majority of cases were in the age group between 31 to 40 years, followed by the younger age groups. Comparing different age groups with affected airway aetiologies is not significant as it depends on the availability of cases at a particular centre. Several studies have been undertaken that highlight the importance of coblation in different age groups [8,9].

With the development of the healthcare sector, more patients are presenting at an earlier stage of the disease, enabling us to operate on them at a younger age. Coblation used in these patients leads to a rapid improvement in symptoms and shorter hospital stays [10,11].

The majority of the patients in present study had laryngeal or tracheal pathology, and hence breathlessness was one of the most common symptoms among them. It was present in 11 patients, out of which 10 had stridor, and decreased oxygen levels were observed in eight of them. Al-Bazzaz F et al., and Geffin B have reported that a laryngo-tracheal narrowing that reduces the airway diameter to 8 mm produces symptoms during exertion, while a stenosis that reduces the airway to 5 mm causes inspiratory obstruction and stridor at rest [12,13].

Most of the patients presented with respiratory distress (73.33%) and a fall in oxygen saturation, along with stridor (53.33%). Chan CL et al., conducted a study on 10 patients, where all of them presented with a certain degree of respiratory distress and two had marked stridor [9]. Respiratory distress and/or stridor are not seen unless there is an obstruction in the central airway, which can lead to acute airway obstruction, often a dire medical emergency. A drop in oxygen saturation is an alarming sign and indicates an acute airway obstruction, which is more commonly seen in glottic and subglottic pathologies [14,15].

During 70-degree scopy, airway obstruction was found in eight patients, whereas indirect laryngoscopy detected airway pathology in only four cases. Indirect laryngoscopy showed no findings compared to 70-degree scopy in detecting subglottic stenosis. It can be concluded that 70-degree scopy provides an enhanced view, better clarity, and improved visualisation of hidden areas compared to indirect laryngoscopy. Therefore, subglottic stenosis was evident on 70-degree scopy, which was not visulised on indirect laryngoscopy.

Using a 70-degree scope to visualise laryngeal lesions provides a better understanding of the pathology as it offers a clearer field of vision and reduces the chance of fogging, enabling visualisation of hidden areas on indirect laryngoscopy [16,17].

However, CT scan has become the investigation of choice before surgery to determine the exact site and extent of the lesion. Virtual bronchoscopy, in particular, is noteworthy as it provides a 3D reconstruction of the airway, aiding in better understanding of the location and extent of the lesion [18,19]. As part of our protocol, CT scan was performed on all the patients, which revealed subglottic stenosis in 53.3% and glottic stenosis in 20% of cases. Therefore, a CT scan may be the best tool for diagnosing airway compromise.

CT is a valuable and sensitive imaging modality for detecting airway pathologies [20]. All patients underwent coblation-assisted airway surgery under general anaesthesia. Intraoperative findings were noted, revealing Grade-II subglottic stenosis in 40% of patients and

Grade-III subglottic stenosis in 27% of cases. The remaining 33% of cases had other causes of upper airway obstruction.

Coblation was used to release laryngeal obstructions, and in the majority of cases (87%), blood loss was less than 10 mL. There was minimal collateral damage and limited scar tissue formation, consistent with other studies [4,9,21,22].

The average hospital stay observed in the majority of the patients was five days, with no significant postoperative complications.

In present study, five patients showed improvement from Grade-II to Grade-I subglottic stenosis, while two patients improved from Grade-III to Grade-II subglottic stenosis. However, three cases did not show any improvement. Similar results have been reported in studies on coblation-assisted subglottic stenosis release [23]. Huang J et al., have also emphasised the precise and rapid ablation integrated with suction and coagulation functions of this technique compared to traditional surgical resection and anastomosis [24].

One case of laryngeal papillomatosis that was successfully removed using coblation. On follow-up, the patient did not show any recurrence. She CP et al., studied 21 cases of laryngeal papillomatosis treated with coblation and reported four cases of recurrence [25]. Few long-term follow-up studies have shown a reduction in the frequency of disease recurrence per year per patient with increasing age, suggesting that the disease may improve as immunity improves [26]. However, in the present study, the presence of a single patient and a shorter follow-up period can be confounding factors.

In this study, a patient with bilateral abductor vocal cord palsy was treated using Dennis Kashima's surgery with coblation. However, the patient did not showed significant improvement on follow-up. This finding was not in line with the study conducted by Benninger MS et al., which demonstrated a 100% improvement in cases of bilateral vocal cord palsy without postoperative stenosis, concluding that this technique was a safe and effective approach for treating bilateral abductor vocal cord palsy [27]. The non concordance in present study may be attributed to the presence of a single case compared to other studies. Moreover, it has been postulated that under-correction of the airway is better than over-correction, as it allows for simpler revision surgery if needed. Over-correction during the initial airway procedure often results in a poorer voice outcome and can make revision surgery more challenging [28]. In our patient, fibrosis had developed, which is considered a common phenomenon [29], and it can be reduced by preserving the inter-arytenoid mucosa.

JNAF is a benign, locally invasive vascular tumour that typically affects young males and is located in the sinonasal region. Due to the absence of a tunica media layer, this tumour is prone to intraoperative bleeding, which can limit resection and increase the risk of complications. In present study, endoscopic JNAF excision using the coblation technique resulted in minimal intraoperative blood loss and only postoperative fibrotic changes on follow-up was observed, with no evidence of recurrence in the patient [30].

A similar study conducted by Cannon DE et al., on a series of four patients who underwent coblation-assisted endoscopic resection also suggested that coblation is a relatively safe and efficient modality [31]. It reduces bleeding, decreases the need for instrumentation, and improves visualisation during surgery.

In present study, on subsequent follow-up at one month, three months, and six months, 73% of the patients showed improvement, while no improvement was seen in 27% of the cases. Coblation reduces postoperative morbidity, and direct endoscopic visualisation ensures complete excision of the pathology. The use of small tips for dissection allows access to all areas, resulting in a significant reduction in residual tissue. Additionally, minimal damage to surrounding tissue is an added advantage, leading to shorter hospital stays. However, the high cost of the coblator wand limits its use, particularly in patients from lower socio-economic backgrounds.

This study highlights the potential of coblation technology to revolutionise airway surgeries, but further research and larger-scale studies are necessary to establish its efficacy across a broader patient population.

Limitation(s)

The study is limited by a small sample size, which consisted of only 15 patients. This sample size was chosen due to the limited availability of patients at the tertiary care centre during the COVID-19 pandemic. The pandemic resulted in a reduced number of patients seeking medical care, as well as our hospital being designated as a COVID-19 referral centre during the study period. Additionally, our hospital primarily serves the economically disadvantaged population, which further limited patient recruitment due to the lack of financial support for acquiring the expensive wands required for coblation surgeries.

Another limitation was that the study was conducted at a single tertiary care centre, which limits the diversity of patient demographics and clinical presentations. This may affect the generalisability of the findings to a broader population.

It is important to acknowledge these limitations and consider them when interpreting the results of the study. Further research with larger sample sizes and multicentre studies are needed to overcome these limitations and provide more robust evidence regarding the efficacy of coblation in airway surgeries.

CONCLUSION(S)

Coblation-assisted surgeries offer precise treatment for various pathologies, leading to positive outcomes in conditions such as subglottic stenosis and laryngeal papillomatosis. The study showed that 73% of patients demonstrated improvement after undergoing coblation-assisted procedures, highlighting the potential benefits of this technique compared to traditional methods. Additionally, the study revealed that patients who underwent coblation-assisted surgeries experienced shorter hospital stays, with the majority requiring only five days of hospitalisation. Furthermore, these patients also showed improved healing.

REFERENCES

[1] Woloszko J, Gilbride C. Coblation technology: Plasma-mediated ablation for otolaryngology applications. NASA ADS [Internet]. 2000;3907:306-16. Available from: https://ui.adsabs.harvard.edu/abs/2000SPIE.3907..306W/abstract.
[2] Carney AS, Timms MS, Marnane CN, Krishnan S, Rees G, Mirza S. Radiofrequency coblation for the resection of head and neck malignancies. Otolaryngol Head Neck Surg. 2008;138(1):81-85. Doi: 10.1016/j.otohns.2007.08.022. PMID: 18164998.
[3] Sergeev VN, Belov SV. Novyi metod vysokochastotnoi élektrokhirurgii (coblation-tekhnologiia) [A new method of high-frequency electrosurgery (coblation technology)]. Med Tekh. 2003;(1):21-23. Russian. PMID: 12608067.
[4] Baker S, Kelchner L, Weinrich B, Lee L, Willging P, Cotton R, et al. Pediatric laryngotracheal stenosis and airway reconstruction: A review of voice outcomes, assessment, and treatment issues. Journal of Voice: Official Journal of the Voice Foundation. 2006;20(4):631-41. https://doi.org/10.1016/j.jvoice.2005.08.012.
[5] Monnier P, Dikkers FG, Eckel H, Sittel C, Piazza C, Campos G, et al. Preoperative assessment and classification of benign laryngotracheal stenosis: A consensus paper of the European Laryngological Society. European Archives of Oto-Rhino-Laryngology: Official Journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS): Affiliated with the German Society for Oto-Rhino-Laryngology- Head and Neck Surgery. 2015;272(10):2885-96. https://doi.org/10.1007/s00405-015-3635-4.
[6] Grundfast KM, Strong MS, Vaughn CW, de Vos P. Suspension microlaryngoscopy in the Boyce position with a new suspension gallows. The Annals of Otology, Rhinology, and Laryngology. 1978;87(4):560-66. https://doi.org/10.1177/000348947808700419.
[7] Matthew B, Padalia D. Anatomy, Airway. PubMed, StatPearls Publishing, 2020, www.ncbi.nlm.nih.gov/books/NBK459258/.
[8] Fastenberg JH, Roy S, Smith LP. Coblation-assisted management of pediatric airway stenosis. Int J Pediatr Otorhinolaryngol. 2016;87:213-18. Doi: 10.1016/j.ijporl.2016.06.035. Epub 2016 Jun 16. PMID: 27368474.
[9] Chan CL, Frauenfelder CA, Foreman A, Athanasiadis T, Ooi E, Carney AS, et al. Surgical management of airway stenosis by radiofrequency coblation. J Laryngol Otol. 2015;129(S1):S21-S26.
[10] Choi KY, Ahn JC, Rhee CS, Han DH. Intrapatient comparison of coblation versus electrocautery tonsillectomy in children: A randomized, controlled trial. J Clin Med. 2022;11(15):4561. https://doi.org/10.3390/jcm11154561).

[11] Nath K, Gupta R. Coblation tonsillectomy: Our experience as a day care procedure. International Journal of Otorhinolaryngology and Head and Neck Surgery. 2021;7(5):764-767. https://doi.org/10.18203/issn.2454-5929.ijohns20211566.
[12] Al-Bazzaz F, Grillo H, Kazemi H. Response to exercise in upper airway obstruction. Am Rev Respir Dis. 1975;111(5):631-40. https://doi.org/10.1164/arrd.1975.111.5.631).
[13] Geffin B. Stenosis following tracheostomy for respiratory care. JAMA: The Journal of the American Medical Association. 1971;216(12):1984-88. https://doi.org/10.1001/jama.1971.03180380042009).
[14] Jagpal N. Subglottic stenosis- statpearls- NCBI bookshelf [Internet]. 2023 [cited 2023 Aug 30]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563265/.
[15] James David Garnett. Subglottic stenosis in adults [Internet]. Medscape; 2023 [cited 2023 Aug 31]. Available from: https://emedicine.medscape.com/article/865437-overview.
[16] Eryilmaz A, Akmansu H, Topcu E, Acar A, Korkmaz H. The role of 70-degree telescopic examination during direct laryngoscopic evaluation of laryngeal cancers. Eur Arch Otorhinolaryngol. 2004;261(5):267-69. Doi: 10.1007/s00405-003-0674-z. Epub 2003 Sep 9. PMID: 13680261.
[17] Zhang X, Li W. Misguidance of peroral rigid laryngoscopy in assessment of difficult airway: Two comparable cases in microlaryngeal surgery. BMJ Case Reports. 2013;bcr2012008423--bcr2012008423. https://doi.org/10.1136/bcr-2012-008423.
[18] Kuo CFJ, Leu YS, Kuo R, Su CH, Yuan TC, Ke BH, et al. Three-dimensional reconstruction of trachea using computed tomography imaging as therapy for tracheal stenosis in infants. Computer Methods and Programs in Biomedicine. 2016;132:177-87. https://doi.org/10.1016/j.cmpb.2016.04.02.
[19] Salomon Waizel-Haiat M. Tracheal stenosis imaging [Internet]. Medscape; 2021 [cited 2023 Aug 31]. Available from: https://emedicine.medscape.com/article/362175-overview.
[20] Roebuck DJ, Murray C, McLaren CA. Imaging of airway obstruction in children. Frontiers in Pediatrics. 2020;8:579032. https://doi.org/10.3389/fped.2020.579032).
[21] Timms M, Bruce I, Patel N. Radiofrequency ablation (coblation): A promising new technique for laryngeal papillomata. The Journal of Laryngology & Otology. 2007;121(1):28-30. Doi: 10.1017/S0022215106003069.
[22] Kostrzewa JP, Sunde J, Riley KO, Woodworth BA. Radiofrequency coblation decreases blood loss during endoscopic sinonasal and skull base tumour removal. ORL J Otorhinolaryngol Relat Spec. 2010;72(1):38-43. Doi: 10.1159/000264791.
[23] Bollig CA, Gov-Ari E. A novel use of coblation in the treatment of subglottic stenosis. Int J Pediatr Otorhinolaryngol. 2018;111:108-10. https://doi.org/10.1016/j.ijporl.2018.05.023.
[24] Huang J, Zhang Z, Zhang T. Tracheotomy-coblation for acquired subglottic tracheal stenosis: A case report. J Cardiothora Sur. 2019;14(1):128. https://doi.org/10.1186/s13019-019-0947-2.
[25] She CP, Zhang QF, Cheng CJ. Coblation treatment for laryngeal papilloma in adult. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2011;46(4):336-38. Chinese. PMID: 21624256.
[26] Reyes LM, Aguilar JL, Villamor P, De La Torre C, Álvarez A, Mantilla E, et al. Clinical and sociodemographic characteristics associated with disease severity in juvenile recurrent respiratory papillomatosis: A study of 104 patients in a tertiary care pediatric hospital. Int J Pediatr Otorhinolaryngol. 2018;108:63-66. Doi: 10.1016/j.ijporl.2018.02.025. Epub 2018 Feb 17. PMID: 29605367.
[27] Benninger MS, Xiao R, Osborne K, Bryson PC. Outcomes following cordotomy by coblation for bilateral vocal fold immobility. JAMA Otolaryngology- Head & Neck Surgery. 2018;144(2):149-55.
[28] Anan V, Kumaran BR, Chenniappan S. Cordoplasty: A new technique for managing bilateral vocal cord paralysis and its comparison with posterior Cordotomy and external procedure in a large study group. Indian J Otolaryngol Head Neck Surg. 2015;67(Suppl 1):40-46. Doi: 10.1007/s12070-014-0740-4.
[29] Oswal VH, Gandhi SS. Endoscopic laser management of bilateral abductor palsy. Indian J Otolaryngol Head Neck Surg. 2009;61(Suppl 1):47-51. Doi: 10.1007/s12070-009-0017-5. [PMC free article] [PubMed] [CrossRef] [Google Scholar].
[30] Gleich LL. Juvenile angiofibroma: Histology and anatomical considerations. Operative Techniques in Otolaryngology--Head and Neck Surgery. 1999;10(2):95-97. https://doi.org/10.1016/s1043-1810(99)80026-8.
[31] Cannon DE, Poetker DM, Loehrl TA, Chun RH. Use of coblation in resection of juvenile nasopharyngeal angiofibroma. Ann Otol Rhinol Laryngol. 2013;122(6):353-57. Doi: 10.1177/000348941312200601. PMID: 23837385.

PARTICULARS OF CONTRIBUTORS:
1. Senior Resident, Department of ENT, Seth GS Medical College and King Edward Memorial Hospital, Mumbai, Maharashtra, India.
2. Head, Department of ENT, Seth GS Medical College and King Edward Memorial Hospital, Mumbai, Maharashtra, India.
3. Senior Resident, Department of ENT, Seth GS Medical College and King Edward Memorial Hospital, Mumbai, Maharashtra, India.
4. Senior Resident, Department of ENT, Seth GS Medical College and King Edward Memorial Hospital, Mumbai, Maharashtra, India.
5. Resident, Department of ENT, Seth GS Medical College and King Edward Memorial Hospital, Mumbai, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Anoushka Sahai,
Acharya Dhonde Marg, Parel, Mumbai-400012, Maharashtra, India.
E-mail: dranoushkasahai@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Aug 09, 2023
- Manual Googling: Sep 14, 2023
- iThenticate Software: Oct 05, 2023 (5%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Aug 08, 2023**
Date of Peer Review: **Aug 25, 2023**
Date of Acceptance: **Oct 07, 2023**
Date of Publishing: **Nov 01, 2023**