

# Management of Supraglottic Stenosis: An Institutional Experience

Shiva Priya Jeyabalakrishnan<sup>1</sup>, Vinoth Manimaran<sup>2</sup>, Sanjeev Mohanty<sup>3</sup>

## ABSTRACT

**Introduction:** Supraglottic stenosis is an unusual subset of laryngotracheal stenosis that has distinctly different causes, associated symptoms, and treatment options, some of which are novel. This is a case series of patients with supraglottic stenosis and the individual treatment options used for each of these patients, and the outcome over a period of 8 years (2010–2017) is analyzed.

**Materials and methods:** Fourteen patients of supraglottic stenosis due to different causes were identified. Quantum of surgery involved release of stenotic segment and placement of stent. All patients underwent CT neck for assessment of the site and extent of stenosis. Endoscopic assisted excision of stenotic segment was performed in 12 patients. Laryngofissure approach was used in two patients as a surgical approach. Periodic assessment of airway was done to ascertain the patency postoperatively.

**Results:** Successful decannulation was possible in 12 out of 14 patients. Stent was removed for all patients. Eleven of the 14 patients are phonating and swallowing well. Other three patients were advised modified swallowing techniques. These patients had esophageal stricture which was released at the same sitting.

**Conclusion:** Trauma was the most common cause of supraglottic stenosis. Endoscopic approach using laser was the most common procedure used to treat supraglottic stenosis with 85.7% success rate in experienced hands.

**Keywords:** FOL, Harmonic scalpel, Management, Stenosis, Stenting, Supraglottis.

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## INTRODUCTION

Supraglottic stenosis poses serious challenges to the practicing otolaryngologist in terms of diagnosis and management. Coexisting conditions such as esophageal stricture make the management plans multifactorial. This study aims at focusing the various treatment plans with successful outcomes for 14 patients who were diagnosed with supraglottic stenosis over a period of 8 years (2010–2017).

## MATERIALS AND METHODS

Fourteen patients diagnosed with supraglottic stenosis due to various causes from the year January 2010 to December 2017 were included in the study.

In the study sample, nine were males and five were females. The age-group ranged from 4 to 56 years (mean—32.35 years).

All patients underwent tracheostomy at the initial assessment to secure airway and quantum of surgery varied based on their etiology and clinical features.

The extent and the location of stenosis were assessed using CT and video laryngoscopy, and flexible fiber-optic laryngoscopy was used to assess the airway and the extent of the stenosis, and grading was done as per the findings.

Surgical treatment encompassed the release of stenotic segment using various techniques, such as KTP 532-nm laser, coblator, harmonic scalpel, and laryngeal microdebrider. Releasing of the stenosis was followed by stenting to prevent adhesion and fibrosis. The various stents used were Bioinert Hood stent, Mc Naughten Keel stent, and silicon tube.

Patients underwent FOL at weekly intervals for assessment of the stent and its position. The stent was removed after 3–9 months (mean—5 months) after the complete evaluation of airway by FOL.

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Decannulation of tracheostomy tube was done as per institutional protocol based on the assessment of airway and patients spigotted. Follow-up was done monthly for a year and at three-month intervals thereafter for next 2 years.

## RESULTS

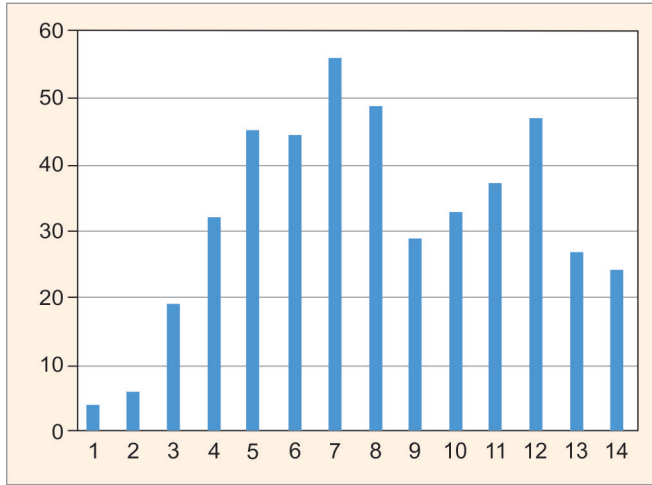
Fourteen patients diagnosed with supraglottic stenosis were included in the study of which nine are males and five females.

Etiology of stenosis was road traffic accidents, organophosphorus compound poisoning, radiation, and congenital as shown in [Table 1](#).

The age-group varied from 4 to 56 years (mean—32.35 years) as shown in the graph ([Fig. 1](#)).

**Table 1:** Etiology

Etiology	No. of patients
Congenital	2
Radiation	1
OPC poisoning	5
RTA	6



**Fig. 1:** Age distribution

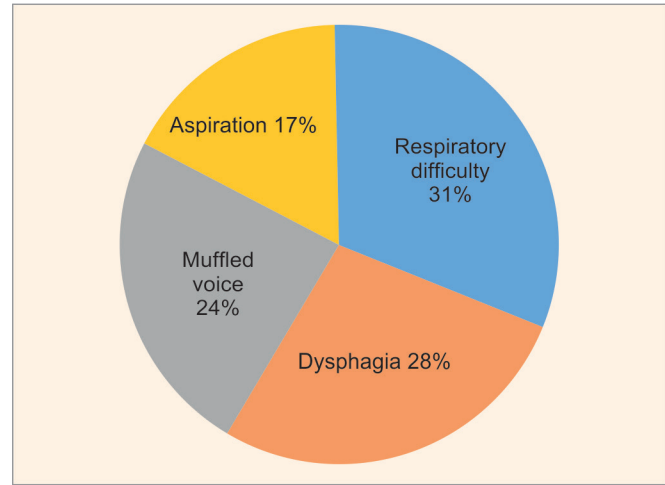
The various complaints with which the patients presented include respiratory distress, muffled voice, aspiration, and difficulty in swallowing as shown in Figure 2.

Individual patient profile based on etiology.

**CONGENITAL**

**Patient 1**

Patient presented to us at 4 years of age, previously tracheostomized due to stridor. Fiber-optic laryngoscopy assessment showed glottic web with fibrous bands between the arytenoids. Release of fibrosis and glottic web was done using KTP laser. Keel stent was placed,



**Fig. 2:** Symptoms

and continuous monitoring was done. Stent was removed after 5 months. Patient was decannulated after 2 weeks.

**Patient 2**

Patient presented to us at 6 years of age. History of tracheostomy and stenosis release was done at the age of 4, but failed decannulation. After initial assessment, patient underwent stenosis release using KTP laser and coblator. Keel stent was placed. Stent was removed after 5 months. Patient was decannulated after 2 weeks.

**RADIATION**

**Patient 1**

Patient, 45/M, postradiation, presented with stridor, and emergency tracheostomy was done. Assessment of larynx showed fibrosis and stenosis of supraglottic region, glottic chink not visualized. Patient underwent stenosis release using KTP laser and laryngeal microdebrider. Hoods stent was placed and secured to the skin. Stent removal was done after 4 months. Patient was decannulated after 2 weeks.

**OPC POISONING**

Patient 1	Tracheostomized 1 year back	Supraglottic stenosis with esophageal stricture	Release of stenosis was done with KTP laser and harmonic scalpel with esophagoscopy and dilatation	Silicon tube was modified	Stent removal was done after 5 months	Decannulated
Patient 2	Tracheostomized 2 years back Stenosis release was done 2 years back, but failed decannulation	Supraglottic stenosis	Release of stenosis was done using KTP laser and microdebrider	Silicon tube was modified	Stent removal was done after 3 months	Decannulated
Patient 3	Presented with stridor Emergency tracheostomy was done	Supraglottic stenosis with esophageal stricture	Release of stenosis was done using laryngeal microdebrider and dilatation of the esophageal stricture	Hood stent was placed	Stent removal was done after 3 months	Failed decannulation. <ul style="list-style-type: none"> <li>• A staged procedure was done after 2 months.</li> <li>• Failed decannulation</li> </ul>



Patient 4	Presented with stridor Emergency tracheostomy was done	Supraglottic stenosis with esophageal stricture	Release of stenosis was done at three sittings	Hood stent was placed	Stent removal was done after 4 months	Failed decannulation
Patient 5	Tracheostomized due to prolonged intubation	Supraglottic stenosis	Release of stenosis was done using laser and coblator	Keel stent was placed	Stent removal was done after 3 months	Decannulated

## ROAD TRAFFIC ACCIDENTS

Patient 1	Patient in stridor, failed intubation, and emergency tracheostomy was done	Failed decannulation and laryngeal examination revealed supraglottic stenosis	Release of stenosis with laser and laryngeal microdebrider	Keel stent was placed	Stent removal was done after 4 months	Decannulated
Patient 2	Tracheostomy was done due to prolonged intubation	Supraglottic stenosis was diagnosed after 1 year	Stenosis release was done with laryngeal microdebrider	Hood stent was placed	Stent removal was done after 3 months	Decannulated
Patient 3	Tracheostomy was done due to prolonged intubation	Supraglottic stenosis was diagnosed due to failed decannulation	Stenosis release was done as staged procedure in four sittings with an interval of 3 months	Keel stent was placed	Stent removal was done after 4 months	Decannulated
Patient 4	Tracheostomy was done due to prolonged intubation	Supraglottic stenosis was diagnosed after 4 months	Stenosis release was done using KTP laser	Silicon tube was modified	Stent removal was done after 4 months	Decannulated
Patient 5	Tracheostomy was done due to prolonged intubation	Supraglottic stenosis was diagnosed due to failed decannulation	Stenosis release was done using laryngeal microdebrider and laser	Silicon tube was modified	Stent removal was done after 5 months	Decannulated
Patient 6	Tracheostomy was done due to prolonged intubation	Supraglottic stenosis was diagnosed after 2 years	Stenosis release was done using harmonic scalpel	Silicon tube was modified	Stent removal was done after 3 months	Decannulated

Of the 14 patients, four patients had already undergone tracheostomy and three patients presented with respiratory distress for whom emergency tracheostomy was done. Seven patients underwent tracheostomy due to prolonged intubation. Thus, all patients underwent tracheostomy after initial assessment of airway using flexible fiber-optic laryngoscopy.

The various parameters assessed in FOL include assessment of glottic chink, vocal cord movement, signs of aspiration, and the extent of stenosis; subsites involved and involvement of subglottis and glottis were also assessed.

Glottic chink and vocal cords were not visualized in 12 patients. Signs of aspiration were seen in five patients, and glottis was involved in two patients (congenital).

All patients underwent computerized tomography to assess the extent and location of stenosis.

Two patients were diagnosed to have congenital stenosis presented at the age of 4 and 6 years with tracheostomy. FOL revealed supraglottic stenosis with glottic web which was identified through retrograde endoscopy.

Of the five patients who had history of OPC poisoning, three had esophageal stricture along with supraglottic stenosis.

## QUANTUM OF SURGERY

All patients underwent initial surgery which aimed at release of the stenotic segment. Endoscopic procedures were done using KTP 532, coblator, or laryngeal microdebrider.

KTP laser was used in 10 patients, coblator was used in three patients, harmonic scalpel was used in one patient, and laryngeal microdebrider was used in conjunction with KTP laser in eight patients. Three patients with severe stenosis required all the three modalities for release of stenosis which was done in two or three sittings. Release of glottis web was done in two patients who were diagnosed with congenital stenosis.

Following the release of stenotic segment stenting was done to prevent adhesion.

Bioinert Hood stent was used in four patients (Figs 3 and 4). Silicon tube was modified and used in five patients, and Mc Naughten keel stent was used in five patients.

Four patients underwent staged surgical procedures for release of stenosis and followed up for definitive treatment.

The stent was secured with buttons placed and sutured over the skin (Fig. 5).

Laryngofissure approach for release of stenosis was done for two patients with severe stenosis.

Three patients with associated esophageal stricture underwent rigid esophagoscopy and dilatation in the same sitting as that of stenosis release.

All patients had Ryles tube feeding for at least 2 weeks postoperatively.

FOL was done after 1 week, to assess the airway and position of the stent.

Three patients had accidental displacement of stent, which was replaced in position.<sup>1,2</sup>

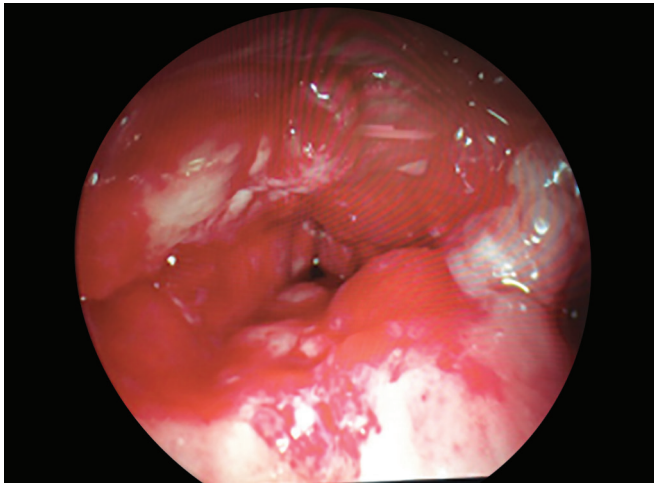


Fig. 3: Vocal cords visualized after stent release

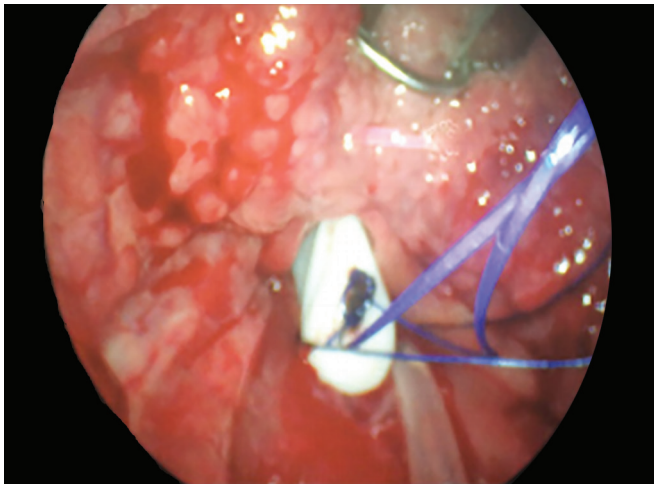


Fig. 4: Hood stent placement



Fig. 5: Stent secured

Stent was removed for all patients at 3–5 months (mean—4 months).

After stent removal, patients underwent spigotting of tracheostomy tube for 24 hours and decannulation as per protocol.

Successful decannulation was done in 12 out of 14 patients (85.7%). The decannulation period was varied from 1 to 4 years.

The two patients who could not be decannulated had history of OPC poisoning and are on regular follow-up.

After decannulation, Ryles tube was removed and feeding was encouraged. Eleven of the 14 patients are phonating and swallowing well. The other three patients were advised modified swallowing techniques to prevent aspiration.

## DISCUSSION

The varied treatment strategies that have to be applied make the diagnosis and management of supraglottic stenosis a challenging entity.

In this study, each patient underwent variety of treatment modality based on the etiology and the individual extent of lesion.

Endoscopic KTP laser excision was the most widely used method of treatment. Laryngeal microdebrider and coblator were used in conjunction. Omar Ramadan in his study<sup>2</sup> about the supraglottic stenosis concluded saying endoscopic approach was the most common procedure used to treat supraglottic stenosis with a success rate of 90%.

In his study, stenosis was found more commonly in females, but in this study, there was a male predominance. He says success rate in isolated supraglottic stenosis is around 95%. Nair et al.<sup>3</sup> in a study on laryngotracheal stenosis has also mentioned 100% success rate in supraglottic stenosis cases. In our study, success rate is around 85.7% with 12 out of 14 patients being successfully decannulated<sup>4</sup> with good phonation.

The etiological factors assessed in his study include trauma, caustic ingestion, and radiation being the common ones which coincides with our study though the poisoning history in the patients included in this study is OPC poisoning. The injuries and edema are relatively less in our patients, and hence, esophagoscopy with dilatation was sufficient.

A single procedure does not suffice for complete treatment of stenosis. Each patient had to undergo two or more procedures for release of stenosis and stenting. Simpson et al.<sup>5</sup> in their study on the predictive factors of success or failure in endoscopic management of laryngotracheal stenosis has discussed that the average number of procedures in successful cases was 6. In our study, the average number of procedures was 4.<sup>6</sup>

In Kacker et al.'s<sup>7</sup> study on surgical management of supraglottic stenosis with a sample size of five patients in which trauma being a cause in three patients, stenting was done by open approach using keel stent and stent was removed in an average of 3 months<sup>8,9</sup> and the decannulation time being 1–4 years which coincides with our study. He has also discussed about the displacement of stent in a patient for whom laryngofissure approach was done to release fibrosis. Stent displacement occurred in three (21.4%) of our patients who had to undergo emergency procedure to replace the stent.<sup>3</sup>

Congenital stenosis was seen in two patients in our study with associated involvement of glottis web. Laser excision and release of web showed good results. Histopathology of the web showed no evidence of acid fast bacilli or any granulomatous lesion. Walner et al.<sup>8</sup> in their study discussed the various causes of supraglottic stenosis in infants such as intubation, infection, prematurity, previous surgeries, and caustic ingestion. The two patients who were included in the study had history of intubation and prematurity which could be correlated.



All patients in this study underwent KTP 532-nm laser excision of stenotic segment. Laser offers effective release associated with good hemostasis and low incidence of postoperative fibrosis. In Simpson et al.'s<sup>6</sup> study, though they have used carbon dioxide laser for the treatment of supraglottic stenosis, have proposed KTP laser as a safe and effective alternative.

Individual treatment strategies had to be employed for each patient. The various types of stent to be used, modification of the stent based on the extent of the stenosis, securing the stent, management of complications like displacement of the stent, recurrence of the stenosis, and multiple procedures to be employed for the release of stenosis make this entity a challenging experience.

This study has its own limitations like a small sample size, but considering that there is not much consensus in the literature to address the condition with various treatment strategies, it has highlighted on the various elements such as etiology, surgery quantum, and management of associated conditions like esophageal stricture.

## CONCLUSION

Supraglottic stenosis if identified at the earliest has good surgical outcomes. Endoscopic KTP 532-nm laser is an effective method for stenosis release and has good surgical outcomes, when combined with other modalities. A meticulous follow-up of the state of the airway postoperatively by flexible fiber-optic endoscopy is required for successful outcomes. Treatment of supraglottic stenosis is a surgeon's dilemma, and individualized treatment is a reality for effective results.

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