

## Review

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# Adult Supraglottic Stenosis: Etiology and Management

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## ABSTRACT

Supraglottic stenosis is a rare entity, which is more common in females, and trauma is the most common cause for it. Dysphagia, dysphonia, dyspnea and stridor are the common symptoms of supraglottic stenosis. Non-symptomatic cases can be managed by observation, and symptomatic cases with severe airway obstruction may need a tracheostomy; some cases may need nasogastric tube to relieve dysphagia. Endoscopic approach using carbon dioxide (CO<sub>2</sub>) laser is the most common procedure used to treat supraglottic stenosis, supraglottic laryngectomy is only indicated for severe supraglottic stenosis. Supraglottic stenosis has high rate of recurrence and may need multiple surgical procedures. Supraglottic stenosis has a better prognosis than glottis and subglottic stenosis with successful treatment rate up to 83%. This is a short discussion about supraglottic stenosis found in literatures; the objective of this study is to present a brief review about this disease.

## INTRODUCTION

The supraglottic stenosis is a rare disease; it is usually difficult to be managed. The most common causes are iatrogenic injury from supraglottic surgery, prolonged intubation, trauma, radiation therapy, caustic ingestion, and autoimmune diseases. Presenting symptoms may include dysphagia, dysphonia, shortness of breath (SOB), stridor and potentially life-threatening airway obstruction. There is a controversy about the optimal treatment of supraglottic stenosis. Historically, open supraglottic laryngectomy was the treatment of choice; however, this was associated by high morbidity connected to chronic aspiration and poor wound healing. Recently, endoscopic approach is more favorable because it is more conservative and associated with less morbidity.<sup>1</sup>

## MATERIAL AND METHODS

Literature review was conducted using PubMed (MEDLINE) and Google Scholar for English articles, the following keywords were used: suraglottic and stenosis; laryngeal and stenosis.

### Inclusion Criteria

All adult patients diagnosed with supraglottic stenosis following any cause were included in the study.

### Exclusion Criteria

Neck malignancies, pediatric cases less than 12 years and burns of the neck.

## RESULTS

Thirty-six studies about surraglottic stenosis have been reported in PubMed (MEDLINE) in English literatures (Table 1).

Case	M/F	Age	Etiology	Site	Tracheostomy	Treatment	Surgery Number	Outcome
Yilmaz et al <sup>1</sup>	3 M 3 F		Letrogenic Autoimmune (SLE) Infection (Rhinoscleroma) Irradiation Caustic ingestion Trauma	4 patients had Supraglottic  2 patients had Supraglottic Glottic Subglottic	Yes all had Tracheostomy	4 Patients had: Microlaryngoscopy CO <sub>2</sub> Laser Scar excision Dilation Mitomicin application  2 Patients had: Laryngeal construction surgery with stent	One  Multiple	4 patients were decanulated  One was decanulated One stayed dependent
Zoghbi et al <sup>2</sup>	F	51	Radiation	Supraglottic glottic	Yes	Microlaryngoscopy KTP Laser Scar excision	Multiple	Decanulated
Freitas et al <sup>3</sup>	F	78	Pemphigoid	Supraglottic	Yes	Medical treatment	NO	Dependent
Gilad et al <sup>4</sup>	F	64	Systemic Amyloidosis	Diffuse Amyloidosis suraglotticpharynex trachea	Yes	No	NO	Dependent
Assanasen et al <sup>5</sup>	F M	24 39	Caustic agent  Trauma	Supraglottic Glottic Sub glottic  Supraglottic Glottic Sub glottic	Yes  Yes	Laryngeal reconstruction surgery  Laryngeal reconstruction surgery	One  One	Dependent  Dependent
Kim et al <sup>6</sup>	M	65	Radiation	Supraglottic Glottic Subglottic	Yes	Laryngeal reconstruction surgery	One	Dependent
Nair et al <sup>7</sup>	M F M		Radiation  Caustic agent  External trauma	Supraglottic  Supraglottic  Supraglottic Glottic Subglottic	Yes  Yes  Yes	Microlaryngoscopy CO <sub>2</sub> Laser Scar excision  Microlaryngoscopy CO <sub>2</sub> Laser Scar excision Laryngeal reconstruction surgery	Multiple  Multiple  Multiple	Decanulated  Decanulated  Dependent
Pegg et al <sup>8</sup>	M	83	Idiopathic	Supraglottic	No	Microlaryngoscopy CO <sub>2</sub> Laser Dilation Scar excision	Multiple	Improved
Lasisi et al <sup>9</sup>	M M		Trauma  Trauma	Supraglottic  Supraglottic	Yes  Yes	Microlaryngoscopy Scar excision with cold instruments Steroid injection  Microlaryngoscopy Scar excision with cold instruments Steroid injection	Multiple  Multiple	Decanulated  Decanulated
Krishna et al <sup>10</sup>	F	61	GERD	Supraglottic	Yes	Transoral supraglottic laryngectomy	One	Decanulated
Saad et al <sup>11</sup>	F	70	TB	Supraglottic	Yes	Microlaryngoscopy CO <sub>2</sub> Laser Scar excision	Multiple	Decanulated
Oosthuizen et al <sup>12</sup>	F	13	Trauma	Supraglottic	No	Microlaryngoscopy Scar excision Dilation Mitomicin application	Multiple	Improved
Rubino et al <sup>13</sup>	F	70	Radiation	Supraglottic Posterior glottic	No	Microlaryngoscopy Scar excision with CO <sub>2</sub> Keel using	One	Improved

Sinacori et al <sup>14</sup>	1 M		Trauma				Microlaryngoscopy Scar excision with CO <sub>2</sub> ballon dilation	Multiple	Decanulated
	1 F		Caustic agent		Yes		Microlaryngoscopy Scar excision with CO <sub>2</sub> ballon dilation	Multiple	
Kiniwa et al <sup>15</sup>	F	37	Epidermolysis Bullosa Acquisita	Supraglottic	Yes		Medical treatment	No	Decanulated
Lyons et al <sup>16</sup>	f	47	Caustic agent	Supraglottic Glottic	yes		Microlaryngoscopy Scar excision with CO <sub>2</sub> microdebrider	Multiple	Decanulated
Davis et al <sup>17</sup>	F	48	Iatrogenic	Supraglottic	Yes		Microlaryngoscopy Scar excision with CO <sub>2</sub>	Mutiple	Decanulated
Duncav Age et al <sup>18</sup>	2F 1M		1 Trauma 2 Caustic agent	Supraglottic	Yes		All three patients had: Microlaryngoscopy Scar excision with CO <sub>2</sub>	Multiple	Decanulated
Doyle et al <sup>19</sup>	F		Caustic	Supraglottic	Yes		Open surgery laryngofissure Remove scar tissue	One	Decanulated
Minni et al <sup>20</sup>	F	62	Iatrogenic	Supraglotic	No		Suprglottic laryngectomy	One	Improved
	M	58	Iatrogenic	Supraglotic	Yes		Supraglottic Laryngectomy	Multiple	Decanulated
	M	35	Trauma	Supraglottic	Yes		Supraglottic laryngectomy	Multiple	Decanulated
Canis et al <sup>21</sup>	M		Iatrogenic	Supraglottic	Yes		Microlaryngoscopy Scar excision with CO <sub>2</sub>	Multiple	Decanulated
Grant et al <sup>22</sup>	3 M 1 F		4 cases of Iatrogenic cause	All four cases Supra- glottic	Yes		All four patients had: Microlaryngoscopy Scar excision with CO <sub>2</sub>	All four patients had: Multiple	4 Decanulated
Alon et al <sup>23</sup>	1 F		Iatrogenic	Supraglotic	Yes		No treatment	No	Dead before treatment
F. Izadi et al <sup>24</sup>	F	12	Fraser syndrome	Supraglottic Glottic	yes		Microlaryngoscopy CO <sub>2</sub> Laser Scar excision	Multiple	Dependent
Moore et al <sup>25</sup>	M	48	Trauma	Supraglottic	Yes		Microlaryngoscopy KTP Laser Scar excision	One	Decanulated
Kacker et al <sup>26</sup>	3 M 2 F		3 Trauma 2 Caustic agent	Supraglotic	Yes		open surgical procedure (excision of the stenosis with repair of the supra glottis area <i>via</i> laryngofissure)	Multiple	All 5 Decanulated
Sunderr Ajan et Al <sup>27</sup>	M		Intubation	Supraglottic	Yes		Microlaryngoscopy Scar excision with CO <sub>2</sub>	Multiple	Decanulated
Stevens et al <sup>28</sup>	4 M 4 F		5 Radiation 3 Autoimmune ( 2 wager, 1 Sarcoidosis)	Supraglotic	Yes		Microlaryngoscopy CO <sub>2</sub> laser Scar excision 6 patient had additional KTP laser in clinic	All patients have Multiple procedures	8 Decanulated
Mistry et al <sup>29</sup>	M	54	Plasmacytosis	Supraglotic	Yes		Dilatation to relieve supraglottic stenosis	One	Decanulated
Rubinstein et al <sup>30</sup>	F	18	TB	Supraglottic	Yes		Microlaryngoscopy CO <sub>2</sub> Laser Scar excision Stent topical mitomicin	Multiple	Decanulated

Belloso et al <sup>31</sup>	M	64	Wagner	Supraglottic	Yes	Medical treatment Microlaryngoscopy CO <sub>2</sub> Laser	One	Decanulated
Bahamonde et al <sup>32</sup>	F	69	Pemphigoid	Supraglottic	No	Medical treatment		Improved
Sims et al <sup>33</sup>	M	50	Sarcoidosis	Supraglottic	Yes	Microlaryngoscopy Scar excision with CO <sub>2</sub> Steroid	One	Decanulated
	F	50	Sarcoidosis	Supraglottic	Yes	Microlaryngoscopy Scar excision with CO <sub>2</sub> Steroid	Multiple	Decanulated
	F	48	Sarcoidosis	Supraglottic	Yes	Microlaryngoscopy Scar excision with CO <sub>2</sub> Steroid	Multiple	Dependent
	M	43	Sarcoidosis	Supraglottic	Yes	Microlaryngoscopy Scar excision with CO <sub>2</sub> Steroid	One	Dependent
Ma et al <sup>34</sup>	M	36	Amyloidosis	Supraglottis anterior commissure	Yes	Microlaryngoscopy Scar excision with CO <sub>2</sub> microdebrider	Multiple	Decanulated
Kaneko et al <sup>35</sup>	F	76	Wagner	Supraglotic	Yes	Medical treatment	No	Dependent
	F	72	Wagner	Supraglottic	No	Medical Treatment Microlaryngoscopy KTP Laser	One	Improved
	F	77	Idiopathic	Supraglottic	Yes	Medical treatment Palliative	No	Dependent
Vira et al <sup>36</sup>	F	50	Radiation	Supraglottic	Yes	Microlaryngoscopy CO <sub>2</sub> Laser Multiple dilation Scar excision Mitomycin application	Multiple	Decanulated
	M	58	Radiation	Supraglottic	Yes	Microlaryngoscopy CO <sub>2</sub> Laser Multiple dilation Scar excision Mitomycin application	Multiple	Decanulated
	F	60	Sarcoidosis	Supraglottic	Yes	Microlaryngoscopy CO <sub>2</sub> Laser Multiple dilation Scar excision Mitomycin application Microlaryngoscopy	Multiple	Decanulated
	F	66	Idiopathic	Supraglottic	Yes	CO <sub>2</sub> Laser Multiple dilation Scar excision Mitomycin application	Multiple	Decanulated

Table 1: Supraglottic stenosis reported cases.

**DEMOGRAPHIC AND ETIOLOGY**

There were 72 patients of age ranged from 12 to 83 with majority of the patients over 50 year old. There were 33 males and 39 females in the study. Forty-six patients had stenosis secondary to trauma, 15 patients had supraglottic stenosis secondary to autoimmune diseases, 4 patients had supraglottic stenosis secondary to infection, 7 patients had stenosis secondary to other diseases (Table 2 Chart 1).

Sixty patients out of them had isolated supraglottic stenosis, while the other 12 patients had multiple sites laryngeal stenosis. Sixty-five patients of them had a tracheostomy, while

the other 7 patients did not have tracheostomy.

**TREATMENT**

One was dead before the treatment, 2 patients had only medical treatment (pemphigoid), 1 patient had only a tracheostomy as a palliative therapy (systemic amyloidosis), 3 patients had tracheostomy and medical treatment (2 patients of them had wagner disease, the other patient had pemphigoid), 52 patients had endoscopic laryngeal surgery (one patient of them had endoscopic supralaryngectomy, 3 patients of them had endoscopic approach using cold instruments, while the other 48 patients had endoscopic approach using Laser), 9 patients had external laryngeal

Trauma	46	63.3%	External trauma	13	<ul style="list-style-type: none"> <li>Three patients without tracheostomy had a surgery and all of them improved</li> <li>Forty-three patients had a surgery for decanulation, thirty eight patients of them were decanulated after surgery, while the other 5 patients stayed dependent on tracheostomy.</li> </ul> <p><b>Successful management rate (41/46) 89%</b></p>
			Radiation	12	
			Caustic agent	10	
			Iatrogenic	10	
			Post intubation	1	
Autoimmune	15	20.8%	Sarcoidosis	6	<ul style="list-style-type: none"> <li>Two patients improved after medical treatment</li> <li>One patient without tracheostomy had surgery and his situation improved.</li> <li>Eight patients were decanulated after surgery.</li> <li>Four patients stayed dependent on tracheostomy.</li> </ul> <p><b>Successful management rate (11/15) 73%</b></p>
			Wagner	5	
			Pemphigoid	3	
			SLE	1	
Infection	4	5.5%	TB	2	<ul style="list-style-type: none"> <li>4 patients were decanulated after surgery.</li> </ul> <p><b>Successful management rate 100%</b></p>
			Sclerema	1	
			Plasmacytosis	1	
Others	7	9.7%	Congenital	1	<ul style="list-style-type: none"> <li>One patient without tracheostomy had surgery and improved after it.</li> <li>Two patients had tracheostomy as palliative therapy</li> <li>Three patients had a surgery for decanulation,</li> <li>Two patients of them were decanulated while the other patient stayed dependent on tracheostomy.</li> </ul> <p><b>Successful management rate (3/7) 42%</b></p>
			Amyloidosis	2	
			GERD	1	
			Idiopathic	3	

Table 2: Etiology, successful rate whatever treatment (59/70) 84%.

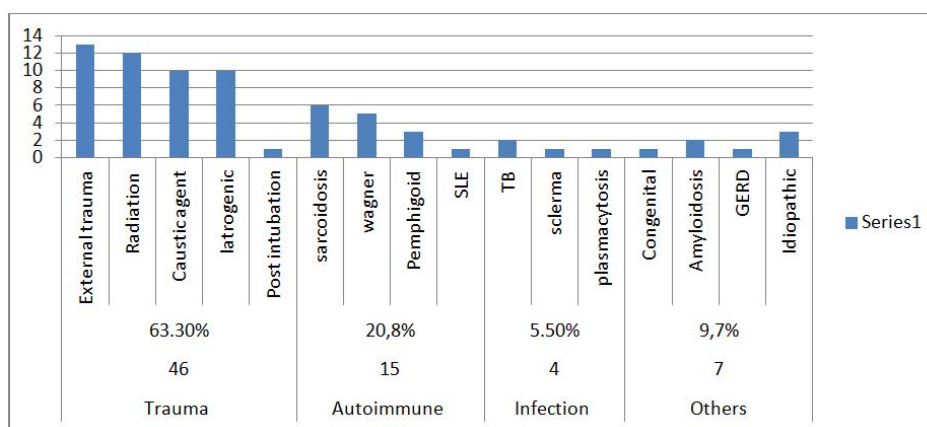


Chart 1

approach (3 patients of them had supraglottic laryngectomy, while the other 6 patients had open surgery using laryngofissure approach), 4 patients had staged laryngeal reconstruction surgery (Table 3 Chart 2).

### DECANULATION

Sixty patients had a surgery for decanulation, 49 patients of them had only isolated supraglottic stenosis (47 patients of them were decanulated, 2 patients stayed dependent on tracheostomy), the other 11 patients with multiple sites laryngeal stenosis including supraglottic stenosis had surgery for decanulation (4 patients of them were decanulated, while the other 7 patients of them stayed dependent on tracheostomy. Most patients need multiple surgeries for decanulation. (Table 4 Chart 3).

### DISCUSSION

Surgery for supraglottic stenosis is usually approached as same as stenosis elsewhere in the larynx.

Non-symptomatic cases may be managed by observation. Surgery is advised for symptomatic cases.

Endoscopic approaches are more favorable than open approaches, but open procedures is usually recommend for difficult and complex cases. For open procedures, a laryngofissure is used to approach and to respect the scar tissue. Partial supraglottic laryngectomy which can be done endoscopically or by open approach is used for severe cases in which the stenosis extends to the glottis. Endoscopic approaches to supraglottic stenosis are

Management	Patients	Patients improved	Successful rate
Medical treatment	2	2	100%
Tracheostomy	1	0	0%
Medical treatment and Tracheostomy	3	0	0%
Endoscopic Laryngeal Surgery (laser, dilation or cold instruments)	52	47	90%
External approach (open supraglottic laryngectomy or open surgery using laryngofissure) for sever supraglottic stenosis	9	9	100%
Staged laryngeal construction Surgery (for severe cases associated with stenosis in another laryngeal areas).	4	1	25%

Table 3: Treatment modalities.

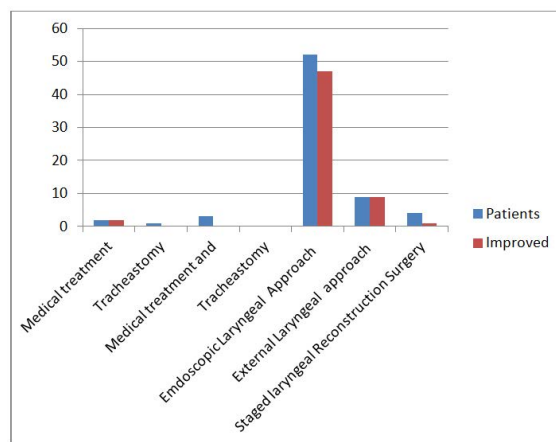


Chart 2

	Isolated Supraglottic stenosis	Multiple sites laryngeal stenosis including Supraglottic stenosis
Patients had a Surgery for decanulation	49	11
Decanulated patients	47	4
Decanulation rate	95%	36%

Table 4: Supraglottic stenosis decanulation.

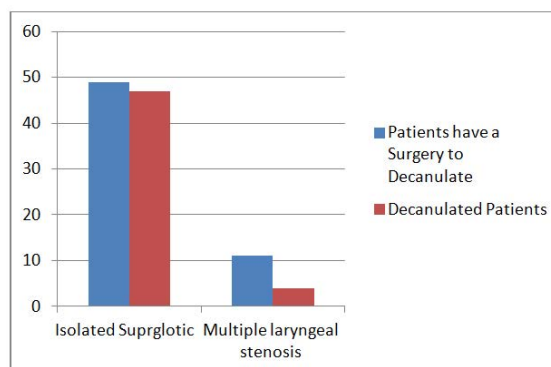


Chart 3

less invasive and often give good results same as open approach. CO<sub>2</sub> laser excision is commonly used because of its ability to resect scar and give good hemostasis at the same time. If the scar tissue extends to the glottis, then cold resection may be good option to protect vocal folds from thermal injury.<sup>25</sup>

Laryngeal caustic injury is associated with oral, pharyngeal and esophagus injury, so panendoscopy consisting of laryngo-tracheo-bronchoscopy and pharyngo-esophago-gastro-

copy is considered to be mandatory. Up to 3<sup>rd</sup> of patients with caustic ingestion may complain of long-term complications such as oral, pharyngeal, laryngeal, and esophageal strictures. The typical clinical course starts 2 weeks after caustic ingestion. The clinical symptoms include upper airway obstruction, dysphagia, and dysphonia/aphonia. The larynx scar is often located at supraglottic area without involvement of the vocal folds. The surgical treatments of caustic pharyngolaryngeal stenosis include open neck surgery or transoral procedures. The 1<sup>st</sup> approach con-

sists of laryngofissure, permanent tracheostomy, and/or laryngectomy. In selected cases, a complete resection of the stenosis is performed and followed by optimal reconstruction. The 2<sup>nd</sup> approach includes using of cold instrumentations or laser.<sup>26</sup>

Intubation usually cause stenosis in subglottic and posterior glottis area, it is uncommon to induce stenosis insupraglottic area.<sup>27</sup>

Laryngeal edema, chondronecrosis, necrosis of soft tissue, necrosis of skin, stricture of pharynx and larynx, and carotid stenosis occur infrequently during head and neck radiotherapy. Treatment of laryngeal stricture caused by radiation is a tracheostomy for respiratory distressed patients, dilation and CO<sub>2</sub> laser to remove scar tissue.<sup>28</sup>

Balloon dilation for supraglottic stenosis is reported in the literature to treat suraglottic stenosis caused by fungal infection.<sup>29</sup>

Laryngeal tuberculosis is rarely reported; it is more common in middle-aged males, and appears with a negative chest x-ray; hoarseness is the most common symptom. Sometimes tracheostomy is necessary to relieve severe laryngeal obstruction. Endoscopic CO<sub>2</sub> laser to remove scar tissue and to insert a laryngeal stent is the treatment of choice for supraglottic stenosis. We can also apply mitomycin-C locally.<sup>30</sup>

The therapy of laryngeal involvement of Wagner disease is based on two components; the 1<sup>st</sup> is the treatment of systemic disease with steroid and immunosuppressant medications, the second is the treatment of local symptoms with tracheostomy, dilation, CO<sub>2</sub> laser vaporization and finally resection of the stenosis segment followed by reconstruction.<sup>31</sup>

Pemphigoid is treated with steroid, immunosuppressant medications and dapson. Tracheostomy is kept for necessary cases, remission is essential so we avoid needing for surgical intervention as well as regular assessment to prevent recurrence.<sup>32</sup>

Laryngeal sarcoidosis more commonly involves supraglottic area. Laryngeal sarcoidosis usually presents with hoarseness, dry cough and dysphagia.

Treatment ranging from closes observing in stable asymptomatic patients to emergent tracheostomy in patients with acute respiratory distress. Systemic steroid therapy is the basic therapy for a systemic disease. Localized laryngeal disease is treated with resection using CO<sub>2</sub> laser with local steroids or mitomycin-C. Open surgical excision and external radiation therapy may be also used.<sup>33</sup>

Amyloidosis is usually localized in the head and neck area, treatment with surgical excision is usually successful for symptomatic cases. In the larynx, a conservative resection using

microlaryngeal surgical approach is recommended with preservation of the surrounding tissue. Recent articles has advocated CO<sub>2</sub> laser as the treatment of choice, recurrence is usually rare and can be treated with further conservative excision.<sup>34</sup>

No history of recent intubation, trauma, or autoimmune diseases should be existed to diagnosis idiopathic supraglottic stenosis which is more common in female.<sup>35</sup>

There are multiple articles reported that the application of local mitomycin-C or corticosteroid during the surgery may decrease the recurrence of the laryngeal stenosis.<sup>36</sup>

**CONCLUSION**

Suraglottic stenosis is more common in female, trauma is the most common cause of supraglottic stenosis, suraglottic stenosis caused by infection has a better prognosis, while supraglottic stenosis caused by autoimmune diseases has a lower rate of decanulation (may be because there is no definite treatment for autoimmune diseases and disease usually recur). Isolated supraglottic stenosis has a good prognosis with 95% successful treatment rate. Endoscopic approach using laser was the most common procedure used to treat supraglottic stenosis with 90% successful rate.

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