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LARYNGO TRACHEAL STENOSIS : MANAGEMENT AND ITS OUTCOMES

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ABSTRACT

introduction: Laryngotracheal stenosis (LTS) implies a partial or complete narrowing of the larynx and/or trachea. Surgical management of it is technically challenging due to complex anatomy and delicate nature of airway structures. Ourstudy aims to study clinical profile, management, and surgical outcome of LTS.

Materials and Methods: All patients with LTS treated between 2015 and 2018 were included in in our study.They underwent endoscopic assessment followed by definitive management which included endoscopic and external surgical techniques. The success of treatment was defined by decannulation Subjective assessment of voice quality.

Results: A total of 30 patients with benign LTS were treated. Prolonged intubation was the single largest cause (56%). subglottic stenosis formed the largest group (74%) followed by Tracheal stenosis (14%).patiens were devided in four group depending upon surgical procedure they underwent:GROUP-I,endoscopic laser excision and dilatation(12cases),GROUP-II laryngo tracheoplasty and t-tube insertion(10 cases),GRUP-III tracheal stent insertion(3 cases),GROUPIV-Rection and anstomosis.Rate of decannalation following this surgical procedure in GROUP-I,GROUP-II,GROUP-III and GROUP-IV were 58%,60%,33% and80%.A total of 19 patients (63%) have been successfully decannulated.

Conclusions: The use of appropriate size, low pressure cuffed tubes, and early tracheostomy will help in preventing LTS. The precise assessment of laryngotracheal complex is most useful in planning of management. Choice of treatment depends on location, severity, and length of stenosis, as well as on patient comorbidities an dhistory of previous interventions. Goal of our treatment modality is to achieve a patent airway and acceptable voice quality.

KEYWORDS : Endoscopic management, laryngotracheal reconstruction, laryngotracheal stenosis, t-tube, partial cricotracheal resection,end to end anastomosis.

INTRODUCTION

- Benign laryngotracheal stenosis (LTS) is a term encompassing partial or complete cicatricial narrowing of the endolarynx or trachea or both. Prolonged endotracheal intubation forms the single largest cause of benign LTS.other cause includes post tracheostomy,accidental injury,inhalation injury,laryngo- tracheal tumors.
- Management of LTS has always posed a significant challenge to the otolaryngologist because the complexity and delicate nature of airway structures such as vocal cords, respiratory mucosa, and recurrent laryngeal nerve make any surgery in this region difficult.
- We describe our techniques of precise airway assessment in such patients. The role imaging in LTS has also been discussed.

In this prospective study, we describe our experience in management of LTS in 30 cases and compare the use of various surgical modalities to determine the best treatment for these difficult patients The outcome of treatment in these patients, who were managed by endoscopic (conservative) and various external surgical procedures, has been analyzed in the form of rate of decannulation.

• AIMS AND OBJECTIVE

To analyse outcome following endoscopic laser dilataion, t-tube insertion,tracheal stent and resection and anastomosis (end to end anastomosis and partial cricotracheal resection and anstomosis (PCTR)) in patient with laryngo tracheal stenosis.

• MATERIALS AND METHODS

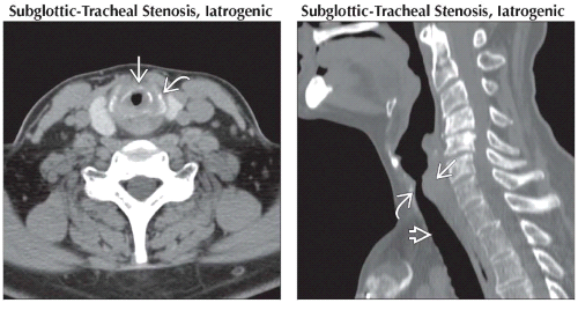
-A prospective analysis and chart review of **30 patients over a period of 3 year 2015-2018** was done.

Detail history was taken and all patients underwent an accurate laryngotracheal assessment to determine the extent of involvement of larynx and trachea, the mobility of the vocal cords.

aetiology of, any suspected case of LTS was evaluated initially by rigid or flexible laryngeal endoscopy: the site of stenosis, degree of luminal narrowing, the length and type of stenosis.

Mayer-Cotton grading is used to describe the severity of subglottic stenosis. Length of stenotic segment is determined by inserting the endoscope to the upper and lower margins of stenosis and by making markings on the endoscope.**Grade I:** <50% luminal obstruction, **Grade II:** 50-70% luminal obstruction,**Grade III:** 71-99% luminal obstruction**Grade IV:** complete luminal obstruction.

In a tracheostomized patient, the endoscope was inserted through the stoma to count the number of uninvolved, healthy tracheal rings low-down up to the carina. Retrograde endoscopy through the site of tracheostomy was done to assess the number of normal tracheal rings, if any, from the lower margin of stenosis to the tracheostoma. A diagram with all the measurements was added to the endoscopy report. Radiological data of **computed tomography neck with a 3D reconstruction** were obtained when necessary.



We consider the patient decannulated when they presented with a closed tracheostomy and did not require additional surgery to restore airway patency for at least six month.

• RESULT:

A total of 30 patients with benign LTS were treated at our institute between 2015 and 2018. There were25 males (83%) and 5females (17%).

Chart- 1 shows the etiological factors responsible for LTS in our patients. In our study postintubation stenosis forms the largest group (56%). The single most important cause of intubation in this group was organophosphorus poisoning.Other causes were post tracheostomy (24%),inhalation burns(10%),traumatic injury (10%).

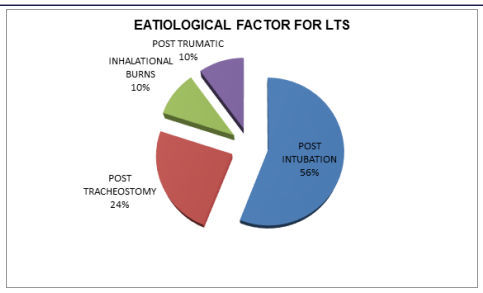


CHART-1

Accoding to consistency 23 patient had hard stenosis and 7 patient had soft stenosis. Among this patient suglotticl stenosis formed the largest group (23) followed by tracheal stenosis (4) and combined stenosis in 3 patient.average length of stenosis is 2.5 cm. The treatment was tailored to the site,grade, and length of stenosis, patient comorbidities and history of previous interventions.accoding to treatment they were devided into 4 Goups.GROUP-I endoscopic laser ablation and dilatation(12 cases),Group-II laryngotracheoplasty and t-tube(10 cases),GroupIII tracheal stent(3 cases) and resection and anastomosis (5 cases). The various interventions along with the treatment outcomes in different groups of patients were summarized.

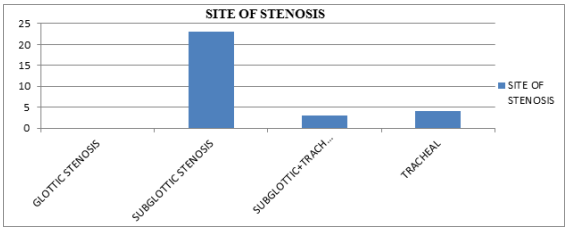


CHART-2

- **GROUP-I(n-12) Endoscopic management:** is reserved for patientswith recent-onset thin and membranous stenosis(fig-1). Radial incisions in the stenosis are made(fig-2,3) using cold instruments followed by dilatation using either tapered bougies or increasing diameters of rigid bronchoscopes,or balloon(fig-4). A cotton swab soaked in 1–2 mg/ml of mitomycin C is applied topically to the site for 1–2 min.The patient is reassessed under anesthesia after 10–14 day, and endoscopic treatmentis repeated, if required. In case of recurrence of stenosis to the same or worse grade, open surgical intervention is considered.

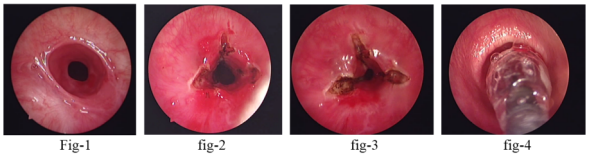


Fig-1 fig-2 fig-3 fig-4

- In our study we managed 12 patient with endosopic laser ablation and dilatation.Among them 8 patients were having grade I and 4 patient having grade-II stenosis.all of these patient had soft memebranus stenosis and average length of stenosis was 1.2 cm.out of 12 patient 7 were decannulated successfully,3patient are in monthly follow up, and 2 patient were failed decannulation on tracheostomy.

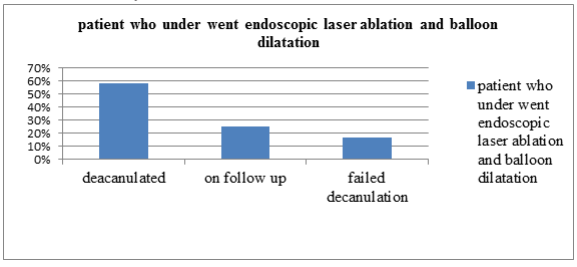


CHART-3

Group 2(n-10)larngo tracheoplasty and t-tube insertion:
The tracheal T-tube was introduced in 1965 by Montgomery, acts as stent maintaining airway patency and a tracheostomy tube, made of silicone. It does not harden at body temperature. It is easy to introduce and maintain the airway patency.stenosis which are greater in length are managed by laryngo tracheoplaty with conchal cartilage grafting and reduired t-tube for stenting.in our study we managed 10 patient wih t-tube insertion,out of them 9 patient having grade-III and 1 patient has grade-IV stenosis.out of this 6 patient were decannulated,3 patient were in regular follow up due to development of granulation on upper and lower end of tubes,1patient developed trachea-oesophagel fistula.

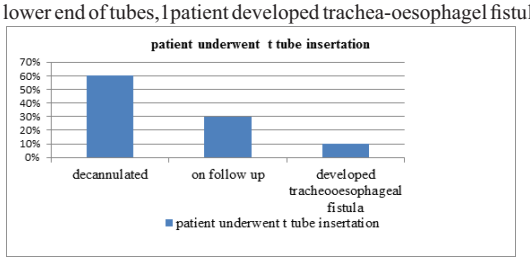
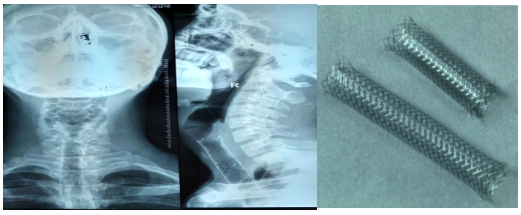


CHART-4

Group-III(n-3)tracheal stent:
1 patient with combined stenosis and 2 patient with tracheal stenosis were managed with metallic stent.all of them having grade-III stenosis.Out of them only 1 patient was decannulated 2 were in follow up due to development of granulations.



Post operative x-ray metallic stent

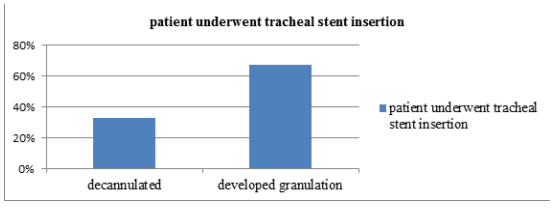
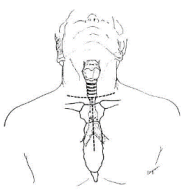


CHART-5

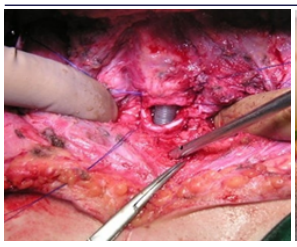
- GROUP-IV(n-5)RESECTION AND ANASTMOSIS: according to site of stenotic segment we performed eighter tracheal resection and end to end anstomosis or partial crico tracheal resection(PCTR) in our cases.For this approach patient isturned to Supine with neck extended with expandable sandbag.Collar incision incision is made Subplatysmal flap is raised superiorly up to (cricoid) and inferiorly up to (sternum).strap muscles are retracted, Trachea dissected close to its wall to expose area of stenosis and not more than 1 cm normal trachea superiorly and inferiorly.Not to injure vascular supply from inferior thyroid,bronchial, subclavian, right internal thoracic, and innominate arteries. Note that vascular supply comes from lateral then transverse intercartilaginous arterioles.
- Circumferential resection of stenotic airway with preservation of normal trachea as much as possible is done. Sterile flexometallic tube is cannulated to distal end. traction sutures are placed at lateral aspect 1cm from edge.posterolateral sutures were taken. the proximal airway was advanced and anterior sutures placed. anastomosis was apposed and tighten traction

sutures anteriory followed by posterior sutures with neck flexed..Skin closurewas done.



POSITION AND INCISION Fig-6

AFTER RESECTION OF STENOTIC SEGMENT fig-7



POSTERO LATERAL SUTURING Fig-8

ANTERIOR SUTURING fig-9

- Chin stay suture was taken (submental to presternal) to keep neck in flexed position. patient was Extubated in the OT.
- For **cricotracheal resection and anstomosis** healthy mucosa from membranous trachea was anastomosed to posterior crecoid lamila and anteriorly thyrotracheal anastomosis was done. Bronchoscopy was done before discharge.
- 2patient who has tracheal stenosis grade-IV around 2.5 cm in length **resection and end to end anastomosis** was done, were decannulated.
- 3 patient who has combined subgottic and upper tracheal stenosis **Partial Creco -Tracheal Resection and anastomosis is done (PCTR)**. all are decannulated on regular follow up but one patient has sutur site dehiscent, t-tube inserted and later on decannulated after one month.thus after resection and anstomosis around 80% patient were decannualted.

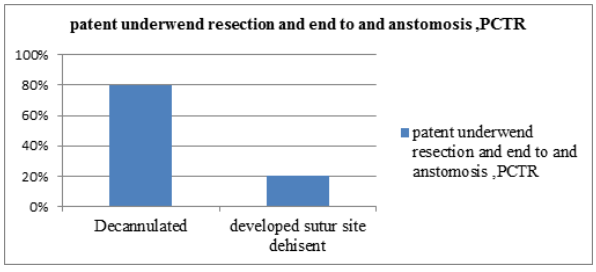


CHART-6

- **OUT COME FOLLOWING ALL SURGICAL PROCEDUR:**

Following above surgical procedure we are abale to decannulate total 18 patient they all having better airway and voice quality,8 patient are on follow up one monthly and 4 patient are failed for decannulation 1 is 3 are on tracheostomy

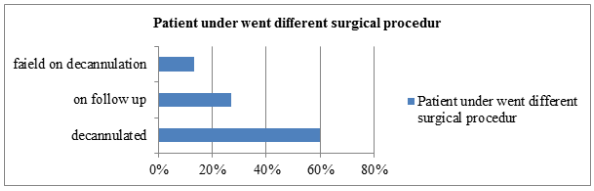


CHART-7

DISCUSSION:

LTS is a disease with high morbidity. BenignLTS may result from various conditions leading to upper airway injury,including endotracheal intubation, tracheostomy, blunt penetrating trauma,inhalation injury.

Of these, prolonged intubation is the single largest causeof LTS.[1] Prolonged intubation with assisted ventilation formed the largest etiological group in our series as well. Reported incidence of tracheal stenosis following tracheotomy and laryngotracheal intubation ranges from 0.6%–21% to 6%–21%, respectively.[2] The main factors responsible for causing postintubation stenosisinclude the duration of intubation, size of tube relative to lumen, cuff pressure, movement of tube during the period of intubation, and cuff material.[4] The incidence of postintubation LTS in ICUs has significantly reduced with the introduction of endotracheal tubes with high volume, low pressure cuffs.[5,6] There seems to be no consensus in literature on the safe time limit before considering tracheostomy in an intubated patient. We generally consider 3–5 days as the optimum period since 56%of patients with postintubation stenosis in our series had been intubated for >5 days. Young, adult males formed the largest subgroup in our review. They are generally more prone to road traffic accidents and assault injuries. In the rural regions catered to by our institute, suicidal poisoning by ingesting organophosphates (used as pesticides in fields), was the single largest cause of prolonged intubation; this again was common in male farmers.Organophosphates cause acute respiratory failure by inhibiting acetylcholinesterase and require prolongedmechanical ventilation.

Detailed and accurate endoscopy of larynx and trachea, as described above, forms an indispensable component of preoperative evaluation in these patients. Indirect laryngoscopy and rigid 0° endoscopy under general anesthesia are done to determine vocal cord mobility,site, grade, and length of stenosis. As far as possible, endoscopic airway evaluation should be done even in a patient presenting with stridor and respiratory distress.[9] This allows the clinician to establish the cause, site, and severity of airway obstruction, which in turn may influence the emergent treatment. The site of stenosis guides the surgeon to appropriate site of tracheostomy.

An early, short-segment stenosis maybe be managed by dilatation and tracheotomy avoided. Out ofV arious treatment modalities have been described in literature. The choice of treatment depends on the site, grade, and lengthof stenosis, as well as on patient comorbidities, history of previous interventions, and on the expertise of the surgical team. The goal should be to achieve a patent airway, glottis competence to protect against aspiration, and an acceptable voice quality.[10]

Various forms of treatment include laser, repeated endoscopic dilatations, prolonged stenting, LTR and segmental resection with end-to-end anastomosis.Endoscopic management of LTS requires a careful selection of patients. We reserve endoscopic techniques for short segment, fresh (or early) subglottic, and tracheal stenosis. For subglottic stenosis, we perform radial incisions using sickle knife followed by dilatation. For tracheal stenosis, we employ dilatations with gradually increasing diameters of rigid bronchoscopes. We prefer bronchoscopes as bougies tend to make the procedure blind and increase the risk of complications such as pneumothorax.The role of endoscopic dilatation has expanded over the past two decades with good long-term outcomes.[11,12]

Oh *et al*. studied the predictive factors associated with a favorable outcome following endoscopic dilatation and found that the patients with mild, shorter, and isolated airway stenosis will have better final outcomes.[12] We believe that topical application of mitomycin-C and steroids (Betamethasone cream) should form an indispensable component of any endoscopic treatment of LTS. Several studies have established the role ofmitomycin-C in reducing restenosis rate after endoscopic treatment and increasing the symptom-free period between successive procedures.[13-15]

As far as open surgical techniques go, there are two broad categories: (a) resection of the stenotic segment withend-to-end anastomosis and (b) PCTR .TRAA is now accepted as the procedure of choice for tracheal stenosis with the excellent results reported in many large series in the literature.[1,16-17] However, when tracheal stenosis coexists with subglottic stenosis, the surgical management becomes technically more difficult.First reported by Pearson, PCTR with thyrotracheal anastomosis has become the treatment of choice for severe subglottic stenosis.[18]

The basic principles of any airway resection and anastomosis include meticulous dissection, preservation of recurrent laryngeal nerves and tracheal blood supply, and avoidance of excessive tension on the anastomosis. The tracheal ring used for the anastomosis should be healthy and steady to prevent dehiscence as well as delayed tracheomalacia at the site of the anastomosis. Sutures should always be placed in the submucosal plane since the breach of mucosa tends to cause granulations at the suture line.

In cases of long-segment tracheal stenosis, laryngeal release procedures may be required to avoid excessive tension at the suture line.[19,20] We have generally used suprarahyoid release in our patients without any issues. As Kato *et al*. showed that outcome regarding swallowing was better with the suprahyoid release.[21]

The inherent advantage of a resection-anastomosis procedure is that the diseased airway is completely removed with formation of a healthy, mucosalized “new” airway which should not be prone to

restenosis, thus, giving this technique the highest possibility of success.

In our case seris we are successfully abal to manage 60% of our patient having better voice and air way quality.higest result is found with resection and anstomosis(80%) with proper patient selection.

• CONCLUSION

The outcome following procedures for LTS was successful in 60% of patients in our cases series. We have also shared our experience and complications encountered.

Use of appropriate size, low-pressure cuffed tubes and early tracheostomy will go a long way in preventing LTS.A precise assessment of laryngotracheal complex is the corner stone of LTS management. The choice of treatment depends on the location, severity, and length of stenosis, as well as on patient comorbidities, history of previous interventions, and on the expertise of the surgical team. The goal of any treatment modality should be to achieve a patent airway, glottic competence, and an acceptable voice quality.

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