

A clinical study of Laryngo- tracheal stenosis

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Abstract: *Introduction:* Laryngo-tracheal Stenosis is a common, complex problem resulting most often from intubation, direct trauma or autoimmune disease. Recently airway trauma has increased considerably owing to increased ventilator care in many emergencies. *Objective of the Study:* The aim of the present clinical study is to review the Aetiology, clinical features and indications of emergency tracheostomy to save life in patients who develop stenosis of the upper airway. The study also reviews the planned repair of the stenosed segment. The upper trachea and Sub-glottis are approached through a midline neck incision and stenosed segment is repaired with Montgomery 'T' tube stenting. *Material and Methods:* Twenty five patients attending Government General Hospital; Kurnool; India, presenting with airway obstruction following discharge after being treated in Emergency care ward were included in this study. A Montgomery 'T' tube was used in 23 patients, resection anastomoses in 1 patient and medical management in 1 patient was undertaken. All the patients were followed for 24 - 36 months with regular follow up. Post extubation radiological improvement. *Results:* The 'T' tube stenting was found to be ideal as it was cost effective, easy to perform under local anesthesia. There was no recurrence in any of the patients till the time of reporting.

Keywords: Larynx; Trachea; intubation; Stenosis; ventilator; sub-glottis; 'T' tube; Tracheal Stenosis; Montgomery.

Introduction

Laryngo-tracheal stenosis resulting due to prolonged intubation for airway management in various indications in intensive care units is becoming common nowadays. Due to constant pressure the inflated cuff of the endotracheal tube causes ischemic pressure necrosis of the tracheal or sub-glottic mucosa. The necrosed mucosa in the presence of infection results in edema of the sub-mucosal planes of tissue in the walls of the trachea. As a result the inflamed and necrosed tissue is replaced by fibrosis in due course of intubation or within 3 to 4 weeks of extubation.

The usual clinical course is that the patient reports back to the Hospital with progressive air way obstruction and sometimes with stridor. The length of the stenosed segment of the trachea depends upon the necrosis and it ranges between 0.5mm to more than 2.5Cms. Meyer and Hoff classification grades the luminal narrowing depending on the diminishing cross sectional area of the lumen.

Various techniques are described in the management of tracheal stenosis. For short segment narrowing Laser ablation is ideal. End to end anastomoses for long segmental narrowing needs extensive dissection in the Neck and thorax resulting in morbidity and likely recurrent nerve paralysis. Shian Yaan Lee method of exposing the stenosed segment, excising the scar and introducing a Montgomery 'T' tube is simple, requires minimal dissection and can be performed under local anesthesia. 'T' tube is well tolerated by the patients and is socially acceptable as it can be closed with an obturator and the patient breathes normally immediately after the surgery.

Post extubation persistence of the dilated segment is reported to be good in the literature. The objective of the present study is to review clinically the various indications for intubation, role of 'T' tube stenting in treating long segment stenosis and long term results of such stenting.

Material and Methods

This study was conducted at Government General Hospital, Kurnool, attached to Kurnool medical college Kurnool, A.P., India. Between June 2009 July 2013. Twenty-five patients were included in the study among which 12 were male and 13 were female. Four patients were in the pediatric group. All the patients presenting with Stridor, difficulty in breathing (malignant, non-inflammatory and F.B cases excluded) to the Emergency OPD were evaluated and included in the study group. Among the 25 patients presenting with airway Stenosis 17 of them presented with history of intubation for various reasons highlighting the crux of intubation hazards on airway. Five patients presented with traumatic history {two blunt trauma and 3-cut throat injury}. One rare case of congenital Stenosis with aberrant subclavian artery noted. Two patients showed marked Stenosis due to granulomatous diseases.

All patients presented with shortness of breath (progressive in 20 patients and acute onset in five of them) necessitating the role of tracheostomy. Bronchoscopic evaluation was the investigation of choice and Digital X ray neck lateral view aided further in diagnosis. Verhulst J, et al. have identified putative risk factors for the development of PI and PT stenosis [1]. Differences in lesions characteristics and stenosis site were noted in our two patient groups. All patients underwent interventional bronchoscopy procedures as the first-line, and frequently the only treatment approach. Role of CT neck and virtual bronchogram was limited and the patients included in this were from a lower socioeconomic class who could not afford those costly investigations.

In two patients with very low tracheal Stenosis where emergency tracheostomy could not serve the purpose planned for repair as early as possible without resorting to tracheostomy. In a patient with supra-glottic Stenosis due to caustic ingestion presented with difficulty in swallowing, occasional coughing and SOB on exertion were present. Regular follow up without any intervention and the patient was doing well at the time of reporting. LASER addressed two patients with glottic Stenosis (laryngeal web) and they are doing well. Two patients of granulomatous diseases on tracheostomy managed by steroids and anti TB drugs with appreciable changes on

follow up bronchoscopy. Resection of fibrosed segment of trachea and end-to-end anastomosis done in one patient in the hands of a senior surgeon and patient is normal at follow-ups. According to Wain JC et al [2] and Gallagher TQ et al [3] the length of the anticipated resection, is the most important determinant of resectability.

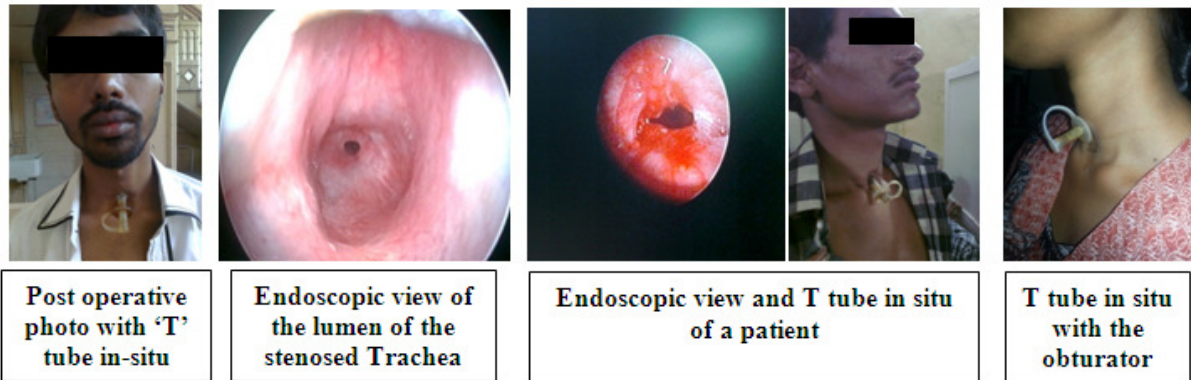
In all the remaining patients in view of the patient's desire of regaining voice, surgeon's choice, Patient's affordability, Montgomery T-tube stenting done. Shian Yan LEE technique used to incise and open the fibrosed segment of the trachea in its anterior wall. After opening the trachea, the fibrosed tissue comes into view. Fibrotic tract excised with monopolar cautery and cold steel. Six patients operated under General anesthesia and the remaining patients under Local anesthesia.

In those patients where general anesthesia was used; after stenting, the upper end of the 'T' tube was closed with the bulb of the Foleys catheter. Out of 23 patients, nineteen patients have a good response while four suffered from granulations from the walls of airway. Topical application of Mitomycin C after surface debulking of these granulations has shown good results in these cases along with steroid nebulisations. Follow up of these Patients done regularly at three-month intervals using a 70-degree endoscope through T tube, to visualize both upper and lower ends of the tube for any granulation tissue formation, the sites of friction due to movement of trachea tree.

Patients followed up regularly after discharge until decanulation of T tube. Montgomery 'T' tube was kept in situ for 24- 36 months. After decanulation, the patients followed up for recurrence in breathlessness or hoarse voice. After extubation X-Ray of the Neck lateral view was taken to judge the improvement in lumen at the site of stenosis. Seyed Reza Seghabia et al opined that although it seems that keeping the 'T'tube in place for more than 6 months may increase the chance of successful decanulation was not conclusive in his study [4]. Three patients presented with Stridor after a gap of 5 months. Incidentally, these patients were asthmatic and had put on

excessive weight in a short period. On clinical examination and endoscopy, lumen was normal. There was no granulation tissue. Symptomatic treatment was given with due attention to the

treatment of Asthma. All the remaining patients responded well for the treatment and went back to their works.



Results

Age & Sex incidence: Among the 25 patients 12(48%) were males and 13(52%) were females. 4(16%) patients belonged to pediatric age group of below 12 years (Table-1).

Sex	Incidence
Male	12(48%)
Female	13(52%)

Aetiology: Tracheal Stenosis following prolonged intubation was seen in 19 (76) % of the patients in the study group. The indications for prolonged intubation being diverse such as Organophosphorus poisoning in 6 (24 %), Supervasol poisoning 7 (28), Hcl Acid ingestion in 2 (8%), caustic ingestion 2 patients (8%) and Intra-cerebral bleed in 2 patients (8%). Four (16%) patients presented with blunt injury to neck and surgical Emphysema with Stridor.

Initial tracheostomy and repair was followed by late complication of Stenosis of upper tracheal segment with residual sub glottic Stenosis.

Similarly, in 2 (8%) patients with Cut-throat injury managed with primary repair preceded by tracheostomy, later developed Stenosis of upper trachea. In the last mentioned groups, a cuffed tracheostomy tube was used. The Different indications for prolonged intubation in this study is shown below.

Indications of prolonged intubation	No. of cases (% wise)
Organ-Phosphorus poisoning	6 (24%)
Supervasol poisoning	7 (28%)
Caustic injury	2 (8%)
Hcl acid poisoning	2 (8%)
Intra cerebral bleed	2 (8%)
Total	19 (76%)

Site of Lesion: Supraglottis, glottis and subglottic areas are sub-sites of larynx while trachea has been classified as proximal and distal trachea i.e. with reference as fifth tracheal ring. Depending on the nature of etiology, site of lesion varies (Table-3).

Nature of Lesion	Supraglottis	Glottis	Sub Glottis & Trachea-proximal	Tracheal Distal
Number of Patients	1 (4%)	2 (8%)	19 (76%)	3 (12%)

As most of subglottic lesions were associated with proximal tracheal lesions, they are named together with subglottic lesions while distal lesions are listed separately.

Nature of Lesion: Sub-glottis and trachea being slightly ovoid structures stenotic segments were

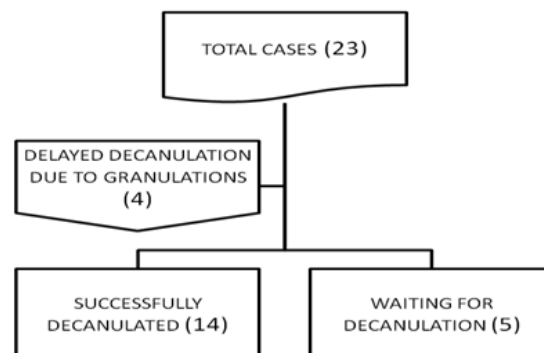
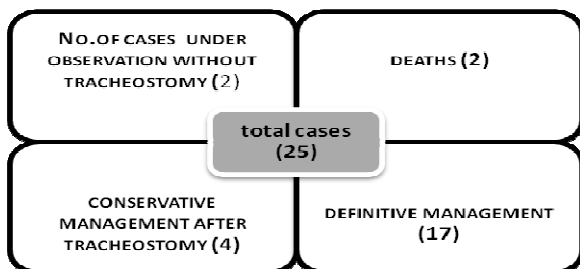
mostly circumferential (3), very few were partial (1) and pinhole type of Stenosis (2). Glottis lesions were in the form of anterior webs. Supraglottic lesion was distorted due to multiple adhesions to surrounding structures.

Sub-glottic

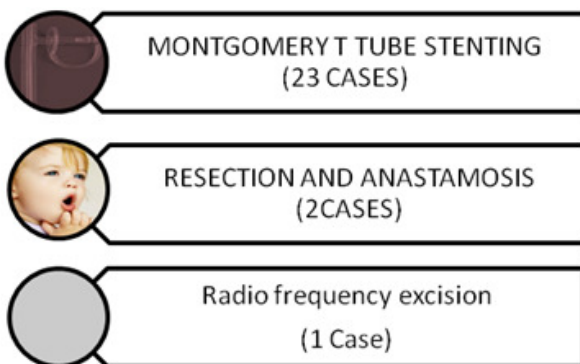


Management: The management in the present study depended on various factors like patient factor, Surgeon’s preference, and economic factor.

Montgomery T-tube was used in Shian Yaan Lee technique in 23 of the patients in correcting the Stenotic segment. The outcome of the procedure:



23 cases were managed surgically by various modalities which are given below:



The incidence of complication is shown in Table-4.

Nature of complication	Incidence
Granulations of trachea at lower end of ‘T’ tube	32%
Recurrence due to early removal of stent	7.5%

Granulations formation was encountered in 32% (8 patients) which might have been the

result of infection, excessive movement of tube against tracheal wall or allergic reaction to stent. They could also form at the upper end of the 'T' tube, but in the present study no case was reported.

Discussion

In the present study 25 patients presenting with difficulty in breathing and Stridor, reporting to the department of ENT, examined and investigated for airway Stenosis. The male to female ratio was equal; 1:1. The gender influence has been controversial in the literature. McCaffrey et al and Mehta et al have reported a predominance of female with tracheal Stenosis in two series respectively. Female predominance also was reported in cases of idiopathic subglottic Stenosis. Liu Z et al have concluded that, Silicon T tube is an effective and safe stent for Laryngo Tracheal reconstruction [5]. As per Herrington et al, Patients undergoing dilatation for LTS require multiple procedures [6]. However major reconstructive procedures are well tolerated and currently represent available primary treatment for LTS.

All of our patients had severe (>50%) tracheal Stenosis with an average degree of Stenosis of more than 70% according to Myer and Hoff classification. Prevalence of Severe tracheal Stenosis should be very low especially since the introduction of large volume, low pressure endotracheal tube cuffs. Avoiding heavy ventilator connecting equipment and meticulous care of the tracheostomy would contribute to lowering the severe Stenosis. A study by Norwood et al who followed 48 intubated patients for 30 months found that only 1 patient (2%) developed severe tracheal Stenosis, while mild to moderate Stenosis was detected in 14 (29.3%) patients. The present series reflects a large referrals from the peripheral hospitals and does not necessarily reflect the true prevalence of the condition.

The site of the Stenosis varied accordingly whether the patient has had tracheostomy or only endotracheal intubation or other etiology. According to [7] Lee JM et al, The longer duration of intubation is associated with a higher incidence of Biofilm linked to Laryngo Tracheal damage. Stenosis that developed as a web around an endotracheal tube cuff is longer and more uniform than the Stenosis around a tracheal stoma

where granulation tissue can extend from a fissure in the anterior trachea or grow into a bulky granulomatous formation surrounding a fracture cartilage.

Most of the patients (23cases) underwent silicon T-tube stenting following stenotic segment release either by cold steel technique or LASER ablation followed by stenting with Montgomery T-tube of which 9cases (70%) are doing well. Rest of the four cases have suffered from granulations following stenting, resulting in delayed decannulation. According to Cynthia et al the occurrence of obstructing granulation tissue after stenting is reported to be 12% to 28% in patients with benign disease and this study results are in correspondence with it. 2 cases of glottis web which were managed by laser excision are doing well with 1year follow up, without any recurrence. Resection and anastomosis done in 1case is doing equally good without any recurrence.

George M et al [8], in their study concluded that appropriate management of LTS requires a high degree of expertise in endoscopic and open-neck surgery. The numerous treatment modalities available for both approaches render patient selection and treatment difficult. For tracheal stenosis, tracheal resection and anastomosis is widely considered the treatment of choice. However, this surgical approach is not feasible when the glottis and sub glottis are involved or in patients with poor general condition. Patients undergoing dilation for LTS usually require multiple procedures. The T tube plays an important role in the treatment of this pathology. However, if the tracheotomy is not removed within 3 surgical interventions, the odds of decannulating the patient decrease significantly and additional surgeries, especially in older patients and in those with higher grade stenosis, may not be beneficial.

Conclusion

Post intubational airway Stenosis is a most common cause of airway Obstruction in the present day scenario of management of critically ill patients in the various Intensive care units. The study includes the duration of intubation varying from, the shortest span

being 2days and the longest span of intubation being 46 days. The average span was 24 days. The symptoms commonly appearing, following the development of Stenosis are, difficulty in breathing, Stridor and in few patients' hoarseness of voice. It is observed in the present study that the symptoms developed between 30 days to 45 days after decanulation. As the primary intention was to save the life of the patients presenting with Stridor initial tracheostomy was done. But in 4 patients as the severity was less intensive primary stenting was done. The performance of tracheostomy initially had no effect on the long term result of stenting.

The length of the stenosed segment observed in the present study was between 1 - 4.6 Cms. The Montgomery tube was well tolerated by all the patients in this study. T-tube stenting is the best and relatively cheaper mode of treatment for selective lesions. For lesions below 1 Cm length the other modalities like Laser or Radio-frequency methods can be used. Regular humidification & frequent suctioning with NAHCO₃ may be required, in the initial 48 hours, to prevent T-TUBE blockage by dry crusting. It is observed that the difficulty in managing the secretions by suctioning is because the horizontal segment of the Montgomery tube is at right angles with the vertical segment making it difficult to pass the suction catheter deep inside

the tube. T-Tube suctioning is practically difficult for the patient who developed granulations after stenting were aged less than 18 years. Frequent follow ups of stenting cases with Bronchoscopy is essential in the success. Application of topical mitomycin C for 6 min after excision of granulations by radiofrequency/electro-cautery reduced the incidence of granulations. Resection and anastomosis another method that is used in the present study. In this patient, the segment narrowed was 3.8 Cms. The Trachea was mobilized above and below the narrow segment. The Stenosed segment was excised and end to end anastomosis was done. This is the best procedure for selective lesions but only in hands of a well-trained surgeon.

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