

Laryngotracheal Stenosis –Etiology And Management

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I. Introduction

Laryngotracheal stenosis is a complex problem resulting most often from intubation, trauma, or autoimmune disease. In this modern era, airway trauma has increased by considerable number owing to increased ventilator care in many emergency situations. Anaesthetists timely intubation saves the life of a patient but he must also be able to foresee the chaotic life of a prolongedly intubated patient who might develop stenosis.

This current study on LARYNGOTRACHEAL STENOSIS enumerates the etiological pathophysiology and clinical presentation. Out of 1,46,845 outpatients seen at our hospital, 36 cases of airway stenosis were noted with various etiologies. Among them only 25 cases were followed up regularly and were included in the study. Patients proven to have airway stenosis (non malignancy/ non obstructive) of all age groups were included and few cases with very low down tracheal stenosis were excluded from the study. After their admission into the hospital, preliminary workup and management, they were discharged and followed up at 1 month, 3 months, 6 months interval. Cumulative result of study of all those cases is summarized here.

II. Aims Of The Study

Clinical study of LTS was done to observe the various etiological causes for it and major concentration was towards the post intubational stenosis. With increasing ventilatory support for varied reasons in present day intensive care setup, the incidence of stenosis following intubation has equally risen. Management of these cases needs a great surgical expertise, due to high failure rate as well as many complications. T-tube stenting has been relatively easier modality of surgical treatment and it also subserves the purpose of regaining voice producing ability after tracheostomy. Apart from observing other types of treatments, T-tube stenting, its complications, their management and results have been studied.

III. Materials And Methods

This study is conducted at GOVT. ENT HOSPITAL, KOTI, Hyderabad a between 2014 October & 2016 October. A total number of 25 patients were studied among which 12 were males and 13 were females. Only 4 children (below 12 years) were among the group. All the patients presenting with stridor, difficulty to breathe (Patients with malignant tumors of airway, Foreign bodies in air passage and paralytic conditions of the vocal cords were excluded from the study) were evaluated.

Among the 25 patients with airway obstruction due to airway stenosis evaluated, majority of the patients presented with history of intubation for various reasons highlighting the crux of intubation hazards on airway. 5 cases presented with traumatic history {2 blunt trauma and 3 cut throat injury}. One rare case of congenital stenosis with aberrant subclavian artery is noted. Two cases showed marked stenosis due to granulomatous diseases.

All patients presented with shortness of breath (progressive in some and acute onset in few cases) necessitating the role of tracheostomy. Bronchoscopic evaluation was the investigation of choice and x ray neck aided further in diagnosis. 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 2 patients of low tracheal stenosis, emergency tracheostomy could not serve the purpose where we had to lose the patients. Tracheostomy saves the patients life and also relieves him/her from the dyspnoea and stridor, but only at the cost of loss of speech, which now becomes the major desire for the patient.

In a patient of supraglottic stenosis due to caustic ingestion difficulty in swallowing, occasional coughing and breathlessness on exertion were present. She was followed up by regularly without any intervention and the patient is doing well. 2 patients of glottic stenoses (laryngeal web) were addressed by LASER followed by keel placement for 6 weeks and they are doing well. 2 patients of idiopathic stenosis on tracheostomy were managed by steroids.

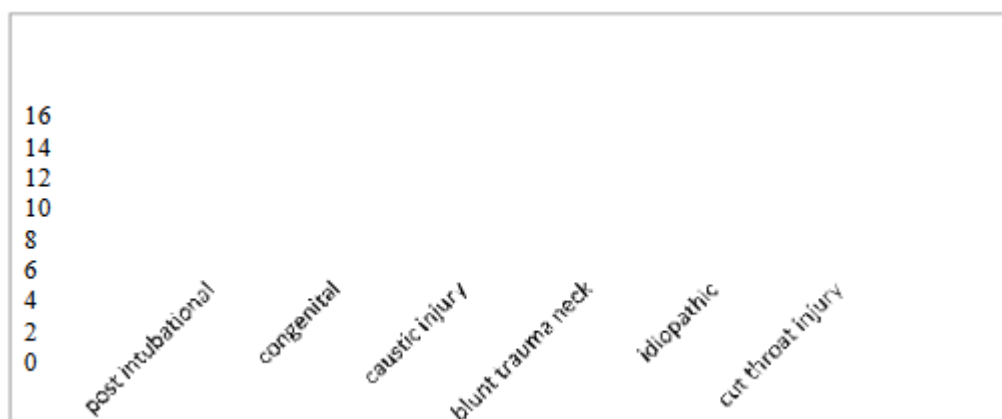
Resection and anastomosis was done in one case in the hands of a well trained surgeon and patient is normal at follow ups. Rest all cases owing to patients desire of regaining voice producing ability, surgeons choice, patients affordability, MONTGOMERY T-tube stenting was done . Of which, 9 patients showed good response while 4 suffered from granulations from walls of airway. Topical application of mitomycin C after surface removal of these granulations showed good results in these cases along with steroid nebulisations. Frequent follow up of these stent patients was done using a 70 degree endoscope to visualize both upper and lower ends of the tube. Cases were followed up regularly after discharge until decannulation. T tube was maintained for atleast an year to 18months before decannulation.

IV. Observation And Results

Age & Sex incidence: out of 25 cases that were studied 12(48%) were males and 13(52%) were females, showing no significant sexual preponderance. Out of 25, there were 4 pediatric cases ageing below 12years.

SEX	INCIDENT
MALE	12(48%)
FEMALE	13(52%)

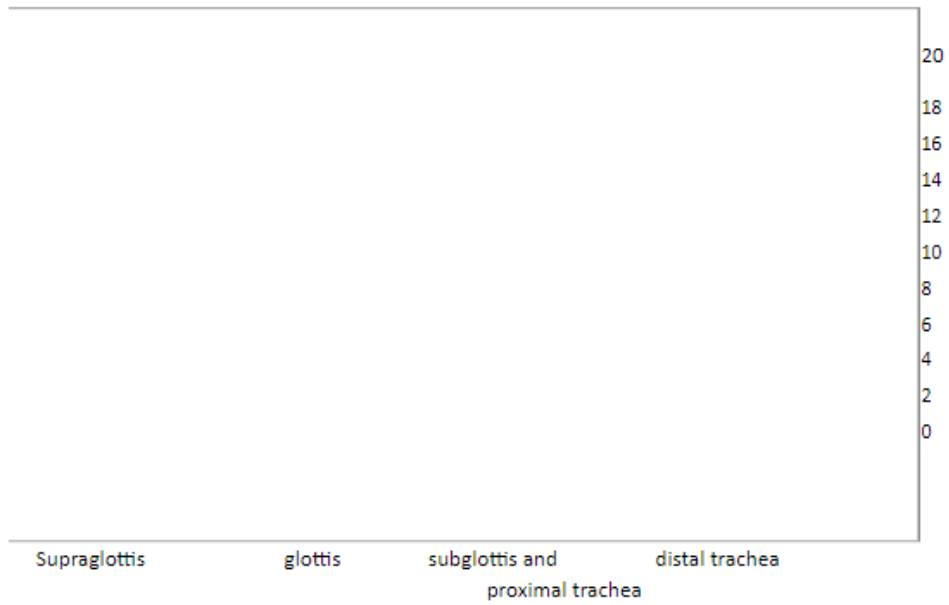
Aetiology: There were varied causes for the development of stenotic airway among which post intubational stenosis was predominant. It shares 64% of the incidence. Reasons for intubation being diverse, its role is not significant. one case of congenital origin and one case of caustic ingestion induced stenosis was reported. 2cases each of blunt trauma induced and idiopathic induced stenosis were noted. And 3 out of 25 cases developed after repair of cut throat injury.



When the history for intubation was taken statistics obtained are as follows...(n=16)

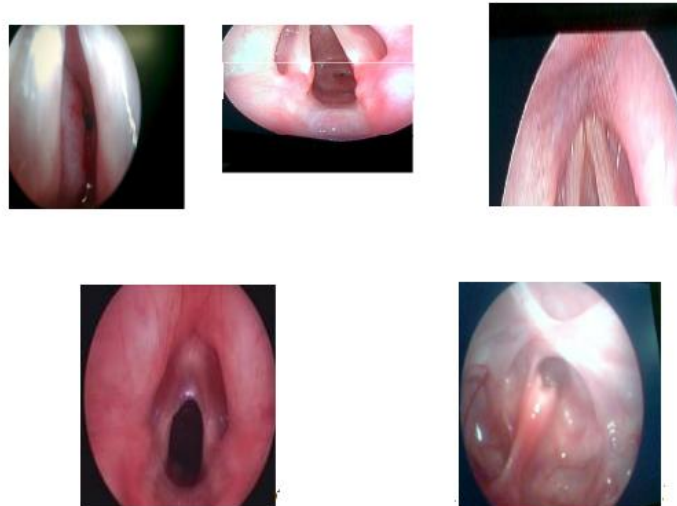
ETIOLOGY	INCIDENCE
o.p poisoning	9
infectious diseases	2
Post surgical	5

SITE of lesion- supraglottis, glottis and subglottic areas are subsites of larynx while trachea has been classified as proximal and distal trachea i.e with reference as 6th tracheal ring. Depending on the nature of etiology, site of lesion varies.



[as most of subglottis lesions were associated with proximal tracheal lesions, they are combined with subglottic lesions while distal lesions are separately listed.]

NATURE OF LESION- subglottis and trachea being slightly ovoid structures stenotic segments were mostly circumferential , very few were partial and also pinhole type of stenoses Glottis lesions were in the form of anterior web. Supraglottis was distorted due to multiple adhesions to surrounding structures.



MANAGEMENT- depending on varied treatment options for LTS, each having its own limitations, multiple modalities of management were practiced owing to patient factors, surgeons factors, economic factors etc .

17 cases were managed surgically by various modalities which are given below.

MONTGOMERY T TUBE STENTING

T-tube management is commonly practiced at our institute for varied reasons among which the results are as mentioned below.

NATURE OF COMPLICATION	INCIDENCE
Granulations of trachea	30%
Recurrence due to early removal of stent	7.5%

Granulations were the main problems in few cases which might have been the result of ?infection, ?excessive movement of tube against tracheal wall ?allergic reaction to stent .. they were noted both above as well as below the tube.

Overall percentages of results are summarized below.

% of stenting cases succeeded	9 out of 13 70%
% of RESECTION ANASTAMOSIS succeeded	3 out of 3 100%
% of deaths conservatively tracheostomy	2 out of 25 8%
Overall success %	% of cases managed 2 out of 25 8%
	15 out of 25 60%

V. Discussion

In this current study 25cases of airway stenosis with various etiologies have been observed. Tracheal stenosis should be considered in the differential diagnosis of any patient who has recently been in an intensive care unit and who presents with exertional dyspnoea or monophonic wheeze, particular when it is unresponsive to bronchodilators as already suggested in shahnaz afrosa et al.[1] In this study Male to female ratio was nearly 1:1. The gender influence has been controversial in the literature. A predominance of female with tracheal stenosis has been reported in two series by McCaffrey et al and Mehta et al respectively [2]contradicting our statistics. Two out of two cases of idiopathic stenosis in this study were females. Female predominance is also reported in cases of idiopathic subglottic stenosis .There were no apparent risk factors like diabetes, smoking, alcoholism, chronic illness in any of the cases for development of these lesions except for the striking etiological cause(post intubational/ post tracheostomy etc.) as already been mentioned in poetkar DM et al.[3]

MacEwen first reported endotracheal intubation for anesthesia in 1880 [4]. Lindholm reported injuries to the larynx and trachea after intubation in 1969 [5].Patients usually remain asymptomatic until the trachea has stenosed to 30% of its original diameter, and it may take as long as three months before the diagnosis according to spittle & mckluskey et al.[6] supporting this study where diagnosis after extubation ranged from 5days to 1year. All of our patients had severe (>50%) tracheal stenosis with an average degree of stenosis of more than 70%. But the incidence of Severe tracheal stenosis prevalence should be very low especially since the introduction of large volume, low pressure endotracheal tube cuffs, elimination of heavy ventilatory connecting equipment, and meticulous care of the tracheostomy as suggested in the article by sajal and sarmista de et al- [7] 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. Our series reflects a large referral network and does not necessarily reflect the true prevalence of the condition.

The site of the stenosis varies according to whether the patient has had tracheostomy or only endotracheal intubation or other etiology. 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[8]. On comparison tracheostomy induced stenosis were relatively lesser than post intubational stenoses in our study.i.e 3:13 cases only. One particular case in this study showed development of tracheal stenosis even after 2days of intubation, which can be supported by study of D R Miller and G Sethi[9] in 1969 which shows development of tracheal lesion after 36hours of intubation. Too old to be added as reference but surely in favor of this study.

The determinant of treatment methods is whether postintubation damage extends to tracheal cartilage or not. For now, there is no accurate diagnostic study for viability of cartilage preoperatively. In the literature, symptoms due to airway stenosis occurred rapidly within one month in the case of patients with necrosis of tracheal cartilage[10]. So it is concluded that the period between extubation and development of symptoms is very informative in the management of postintubation tracheal stenosis. All patients irrespective of mode of permanent treatment assorted were maintained on steroids. Conservatively managed cases which were under steroid cover had a non progressing lesion there after as mentioned in braidy et al [11]- but the inflammatory nature of the lesion (as suggested by endoscopy and radiology), the progressive deterioration in symptoms over one month, and the rapid response to corticosteroids (five days) suggest a therapeutic response to steroids .

Most of our patients(13cases) underwent silicon T-tube stenting[12] following stenotic segment release either by cold steel technique or radiofrequency 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. 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 correlating with it. One of the main drawbacks of these surgeries is the risk of recurrence of tracheal stenosis due to granulation and fibrotic tissue. Silicon tubes considered to be foreign bodies are responsible for infections and granulations (as a reparative process or due to bacterial infection)[13]. 4 out of 13 cases in this study developed granulations after stenting.

Both in vitro and in vivo, Mitomycin C has been proven to be a potent inhibitor of human fibroblasts at concentrations of 0.04 mg/L. It has been used with some success in inhibiting the vigorous granulation response noted after airway injury in animal models and pediatrics[12]. Application of topical medications to shrink the granulation tissue can be effective too. These medications may include steroids, which can be applied directly to the tissue or injected just beneath the granulation tissue. In addition, other medications decrease the number of fibroblast cells, which help to create

granulation tissue.[13] In 4 cases of stenting where granulations posed a problem, topical mitomycin was used and 3 cases showed reduction in bulk of granulation tissue along with post op steroid nebulisations.

Crusting and complete occlusion of T-tube is also noted[14]. Humidification of inspired oxygen, regular suctioning of both limbs of the T-tube, and lavage with normal saline have been recommended to prevent encrusting of the tube- appadurai et al[15]. Even in this study 2cases of tube blockage have been reported when emergency removal of tube had to be done .

In this current study 2cases of glottic web were managed by laser excision and keel placement for 6weeks are doing well with 1year follow up without any recurrence similar to benmansour et al.[16] Resection and anastomosis done in 1case is doing equally good without any recurrence.

Many papers and articles by Grillo, Mehta, Mc caaffrey prove that open surgical techniques and the results of 1st stage procedure are high relatively than a lesion undergoing repeated interventions. As most of this study is inclined towards T tube, discussion and comparisons are limited to it. T-tubes are a satisfactory alternative[17] to tracheal resection and are preferred over interbronchial stents for tracheal stenosis as T-tubes have decreased rate of migration, allow for frequent irrigation and suctioning, are easily removed in case of acute obstruction, and maintain a tracheostomy stoma -suggested by Julie M Schrader [18]. The use of a T-tube in some patients with tracheal stenosis a very good therapeutic method which should be used at present in indicated cases. By Fiala P and colleagues[19]. Thus results of this study are well substantiated from these evidences.

Finally in the review of literature it is found that A bioresorbable stent that scaffolds the airway lumen and dissolves after the remodeling process is completed has advantages over metallic and silicone stents . Kuo shung liu and colleagues designed and fabricated a new mesh- type bioresorbable stent with a backbone of polycaprolactone (PCL), and evaluated its safety and biocompatibility in a rabbit trachea model.[20]

VI. Conclusion

- Ø Post intubational airway stenosis most common cause.
- Ø Shortest span of intubation-2days ; longest span of intubation-17days ; median span of intubation 9 days.
- Ø Post intubational stenosis;onset of symptoms. Earliest- 5days after extubation; maximum duration- 1year after extubation.
- Ø As tracheostomy was commonest & earliest intervention to save life,regaining normal sound production was common desire of all the patients.
- Ø T-tube stenting is the best and relatively cheaper mode of treatment for selective lesions.
- Ø Regular humidification & frequent suctioning with NAHCO₃ in initial stages may be required to prevent T-TUBE blockage by dry crusting.
- Ø T-Tube suctioning is practically difficult for the patient who got used to cleaning the inner tube of silver jackson s.
- Ø All those cases which developed granulations after stenting were aged less than18years.
- Ø Frequent follow ups of stenting cases by Bronchoscopy in a public sector hospital with busy O.T is a bit difficult job, so usage of a 70degree endoscope through stent has been practiced.
- Ø Application of topical mitomycin c for 6min after excision of granulations by radiofrequency/electrocautery reduced the incidence of granulations.
- Ø LASER- usage for this kind of cases is the best alternate to prevent recurrence,but needs experienced practitioner and it is a costly procedure.
- Ø RESECTION & ANASTAMOSIS is best procedure for selective lesions but only in hands of a well trained surgeon.

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