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Study of Laryngotracheal Stenosis and its Management in 25 Cases

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Abstract

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 [1]. Anaesthetist's 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.

Objectives 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 increase. Management of these cases needs a great surgical expertise, due to high failure rate as well as many complications. T-tube stenting has shown to be relatively easier modality of surgical treatment and it has also sub serves 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.

Results: 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 12 years. Speaking of aetiology, post intubational stenosis is the cause in 64%. Reasons for intubation being diverse from blunt trauma (8%), congenitall (4%), and caustic ingestion induced stenosis (4%), after repair of cut throat injury (20%), idiopathic stenosis (8%). Infectious diseases as cause in 8% and organophosphorous poisoning in 36%. Subglottis and proximal trachea were the most common sites for stenosis, followed by distal trachea, glottis and supraglottis in the descending order. Out of 25 cases, 2 cases were followed conservatively without tracheostomy, 4 cases were managed conservatively with tracheostomy, 17 cases were managed surgically definitively and death in 2 cases. Various surgical modalities used were laser excision (2 cases), T tube stenting (13 cases), Radiofrequency ablation (1 case) and resection and reconstruction in 1 case. Out of 17 surgically managed cases, failure was seen in 4 cases.

Keywords: Laryngotracheal stenosis; T tube stenting; Laser excision

Introduction

Pathophysiology

The recommended limits to minimize damage to the trachea are 15-25cm H2O (10-18mmHg). Tracheal capillary pressure lies between 20 and 30mmHg [2]. It suffers impairment at 22mmHg and total obstruction at 37mmHg. In intubated patients Endotracheal tube cuff pressure being exerted on the tracheal wall, becomes the main culprit in majority of the cases. Complications of continued cuff over inflation include tracheal stenosis, trachealmalacia, and tracheosophageal or tracheoinominate fistula, desensitisation of the larynx and potential loss of the cough reflex.

Poiseuille's law

a) R = resistance

b) n = viscosity

c) l = length

d) r = radius

[Because of the fourth power in the denominator, resistance increases rapidly as diameter decreases] [3].

Thus, this equation proves how the tracheal lumen narrowing by stenosis affects resistance.

The process of post-intubation tracheal stenosis is best described as the laryngotracheal bed sore. Transient irritation of tracheal wall by the tube results in edema which heals spontaneously. High pressure cuffs may cause ulceration of

mucosa which initiates healing process leading to tracheal stenosis which may take 3-6 weeks.

Etiology

There are many factors that can lead to laryngotracheal stenosis (LTS). Most cases of adult LTS result from external trauma or prolonged endotracheal intubation. External trauma causes cartilage damage and mucosal disruption with hematoma formation. These hematomas eventually organize and result in collagen deposition and scar tissue formation. Endotracheal intubation can cause direct injury, and mucosal damage through pressure necrosis can result from the pressure of the endotracheal tube or cuff. Mucosal ulceration also leads to healing through collagen deposition, fibrosis, and scar tissue formation. Lesions from endotracheal intubation are usually located in the posterior part of the glottis, where the tube most often contacts mucosa, or in the trachea, where the cuff or tube tip causes mucosal damage. Low-pressure endotracheal tube cuffs have somewhat reduced the rate of cuff-induced damage. The length of intubation, tube movement, tube size, and gastroesophageal reflux can also contribute to the development of LTS [4,5].

Clinical Presentation

Tracheal stenosis can present very insidiously or as a catastrophic near death episode requiring cardiopulmonary resuscitation. Children with congenital tracheal stenosis present with biphasic stridor, tachypnoea, retractions, nasal flaring, apnea, cyanosis, wheezing, noisy breathing, persistant croup and pneumonia. Dysphagia and failure to thrive may be seen occasionally [6].

Patients with acquired stenosis are diagnosed from a few days to 10 years or more following initial injury [7]. Majority are diagnosed within a year; some are misdiagnosed with asthma and recurrent bronchitis. High index of suspicion should arise when history of intubation is noted [8,9] (Table 1).

Table 1:

Presentation[10]	Site of Obstruction
Inspiratory stridor	Larynx
Biphasic stridor	High tracheal obstruction
Prolonged expiration	Tracheal bronchial obstruction
Dysphonia	Laryngeal
Apnea	Laryngomalacia

Classification

Table 2:

GRADE 1	lesions have <50 % obstruction
GRADE 2	lesions have 51% to 70% obstruction
GRADE 3	lesions have 71% to 99% obstruction
GRADE 4	lesions have no detectable lumen or complete stenosis

The Myer-Cotton staging system [11] is useful for mature, firm, circumferential stenosis confined to the subglottis. Four grades of stenosis are described with this system: (Table 2) (Figure 1).

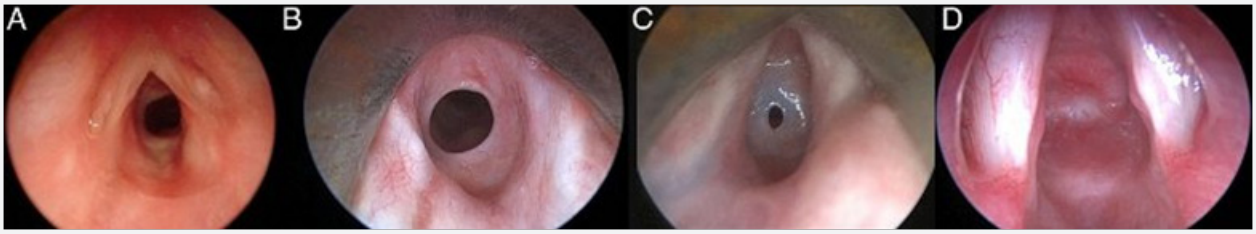

Figure 1: Showing grades 1 to 4 of Myer Cotton Staging System.

The McCaffrey system [12] classifies laryngotracheal stenosis based on the sub sites involved and the length of the stenosis. Four stages are described (Table 3).

Table 3:

STAGE I	lesions are confined to the subglottisor trachea and are less than 1cm long
STAGE II	lesions are isolated to the subglottis and are greater than 1cm long
STAGE III	Lesions are subglottic/tracheal lesions not involving the glottis
STAGE IV	Lesions involve the glottis

LANO system [13] is based on number of subsites involved (Table 4).

Table 4:

STAGE I	One subsite involved
STAGE II	Two subsite involved
STAGE III	Three subsite involved

Diagnostic Assessment

The evaluation of LTS must begin with a meticulous history and physical examination. Since most cases of LTS result from laryngotracheal trauma or endotracheal intubation, the timing of the predisposing incident should be recorded. The entire upper aerodigestive tract must be carefully examined in a patient with suspected LTS [14,15]. Indirect laryngoscopy and flexible fiberoptic laryngoscopy offer critical information regarding the supraglottic airway and mobility of the true vocal folds [16].

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Neck X-Ray

The anteroposterior airway is superb for examining the glottic and subglottic areas. Cross-sectional imaging also adequately shows the airway. Configuration of the airway on axial or transverse images varies depending on the level of the image. At the level of the epiglottis and aryepiglottic folds, the airway is elliptic. Approaching the false cords, the airway narrows and assumes a teardrop shape. The airway becomes elliptic at the true cords. Below the cricoid cartilage, the airway appears circular. The posterior membrane of the trachea may posteriorly flatten, and the normal esophagus occasionally indents the airway silhouette [17] (Figure 2).

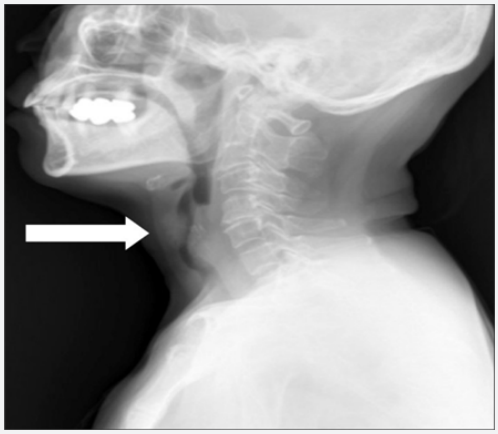

Figure 2: Showing tracheal narrowing in a plain x-ray lateral view.

Other modalities

Although imaging studies such as airway radiographs, computed tomography, and magnetic resonance imaging occasionally provide useful information, the most valuable diagnostic assessment stems from the examination of the patient with endoscopy, either flexible fibre optic or rigid endoscopy.

CT, MRI, VIRTUAL BRONCHOGRAM are equally useful radiological investigation to reconstruct the images of airway in 3d format. Technological advances in CT scanning and MRI have greatly improved radiologist's ability to image the upper airway. Spiral CT scanning and fast MRI techniques allow the use of rapid acquisition speeds that decrease degradation motion artifacts caused by patients breathing and swallowing and carotid artery pulsations. Spiral CT scanners rapidly, in less than 10 seconds, acquire the complete data set through the larynx, limiting the time during which the patient needs to remain motionless. Images can then be reconstructed to create overlapping sections, and coronal, sagittal, and even 3-D images can be generated from the same data set [18].

Helical CT scanning with 3-D reconstruction and virtual endoscopy in neonates and infants can prevent additional diagnostic tracheobronchoscopyin a high percentage of such patients who have tracheobronchial lesions (Figure 3).

Figure 3: Showing narrowing of trachea in CT image of neck and chest.

Treatment of Laryngotracheal Stenosis

Medical

Prior to airway reconstruction, it is recommended that all pediatric patients be evaluated for GER with a dual 24hr pH probe [11]. In adults it is important to evaluate the patients general medical condition prior to performing any reconstructive procedures. It is important to consider each patient's case on an individual basis and make the decision to proceed with surgery based on sound judgment.Relative contraindications to LTR in adults are renal failure, diabetes, severe coronary artery disease, severe COPD or restrictive lung disease, obstructive sleep apnea, and systemic steroid use [19].

Observation

Patients (children and adults) with Cotton-Myer grade I and mild grade II subglottic stenosis may sometimes be managed with close observation (Walner and Cotton, 1999).

Surgical treatment options for subglottic stenosis:

a) Tracheostomy

b) Endoscopic

i. Dilation

ii. Endoscopic laser excision

c) Open procedure

i. Expansion procedure27 (one-stage or with stent placement)

a. Anterior cricoid split ± cartilage graft

b. Posterior cricoid split ± cartilage graft

c. Anterior and posterior cricoid split + cartilage graft

d. Four quadrant LTR

ii. Segmental resection (cricotracheal resection - CTR)

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A. Primary CTR

B. Salvage CTR

C. Extended CTR

Endoscopic treatment

Some areas of LTS are amenable to endoscopic treatment techniques such as laser vaporization and dilation, excision using a microtrapdoor technique, or serial dilation with radial incisions of the stenotic segment. Intralesional corticosteroids may also be injected under endoscopic guidance [20].

Owing to its precision (small spot size) and availability, the carbondioxide laser, which produces light in the mid-infrared region, remains the instrument of choice in the endoscopic management of LTS. It can be used to coagulate vessels up to 0.5mm in diameter. If the stenotic area is vascular, a laser with better hemoglobin absorption, such as the potassium titanyl phosphate/532 (KTP/532) or neodymium: yttrium-aluminum garnet (Nd:YAG), is recommended [21].

Open surgical techniques

Severe areas of LTS that do not respond to endoscopic techniques require an open surgical procedure. Open techniques attempt to either excise the stenotic segment and reanastomose the airway or augment the circumference of the stenotic segment with transplanted tissue. In the high risk patients, a tracheostomy may be the most prudent choice of management.

Tracheal resection and reanastomosis

Areas of cervical tracheal stenosis up to about 5cm can generally be excised, and the proximal and distal tracheal segments reanastomosed primarily.

Laryngotracheal stents

Laryngeal and tracheal stents are solid or hollow absorbable or nonabsorbable tubes of various shapes, sizes, and materials. Stents are used as primary treatment for lumen collapse or to stabilize a reconstructive effort of the larynx or trachea to prevent collapse.

Types of stents [20]: Different stents have different indications. Types include primarily laryngeal stents, primarily tracheal stents, combination tracheal and laryngeal stents, and stents that can be used either in the larynx or trachea.

Laryngeal stents: If stenosis is confined to the larynx (i.e., glottis, subglottis), stenting can be short- or long-term. Short-term stenting is defined as stenting for less than 6 weeks. Long-term stenting is defined as stenting for more than 6 weeks. Use short-term stenting for stabilization of cartilage grafts following laryngotracheal reconstruction (LTR) and/or for separation of mucosal surfaces during healing following laryngeal trauma, repair of web formation or atresia, or excision of a laryngeal lesion. Stents for these indications include Aboulker stents, silicone stents, Montgomery laryngeal stents, endotracheal tubes, and laryngeal keels (Figure 4).

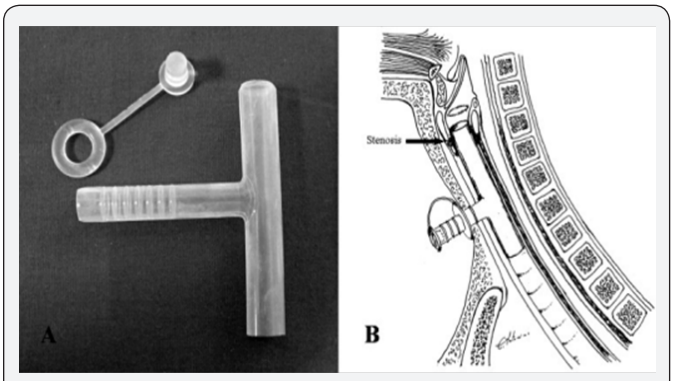

Figure 4: Montogmery tube.

Occasionally, long-term stenting is required when the trachea above the tracheotomy tube requires stenting for either collapse or stenosis following reconstruction. In this case, a long stent wired to the trachea, shown in the images below, or a tracheal tube (T-tube), such as the Montgomery T-tube, shown below, can be used.

Materials and Methods

This study is conducted at GOVT.ENT HOSPITAL, KOTI, Hyderabad between 2012 october & 2016 January. 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 strid or, 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 lowtracheal stenosis, emergency tracheostomy could not serve the purpose where we had to loose the patients. Tracheostomy saves the patient's 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

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of glottis stenoses (laryngeal web) were addressed by LASER followed by keel placement for 6weeks and they are doing well. 2 patients of idiopathic stenosis on tracheostomy were managed by steroids.

Resection and anastamosis 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 patient's desire of regaining voice producing ability, surgeon's choice, patient's 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 decanulation. T tube was maintained for atleast an year to 18 months before decannulation.

Observation and Results

Age and 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 12 years (Table 5).

Table 5:

Sex	Incidence
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 (Figure 5). When the history for intubation was taken statistics obtained are as follows... (n=16) (Table 6).

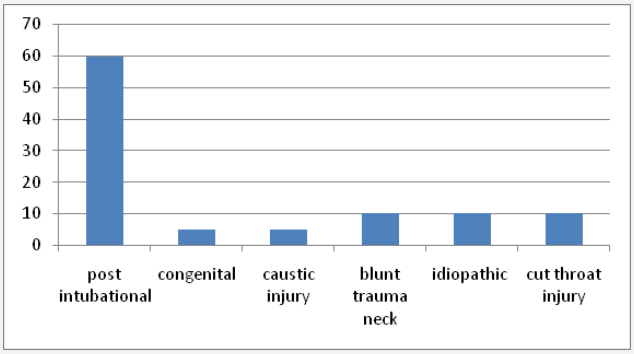

Figure 5: Showing line diagram for etiology of laryngotacheal stenosis.

Table 6:

Etiology	Incidence
OP poisoning	9
Infectious disease	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 (Figure 6). [As most of subglottis lesions were associated with proximal tracheal lesions, they are combined with subglottic lesions while distal lesions are separately listed.]

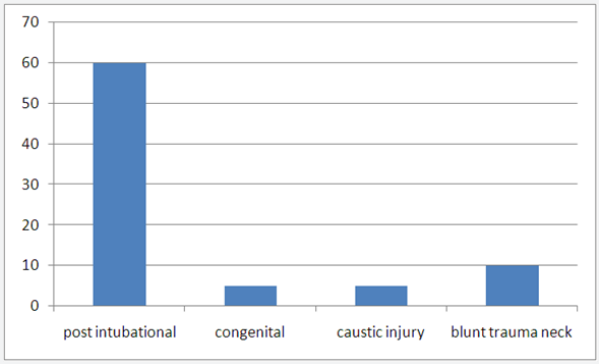

Figure 6: Line diagram representing causes of LTS.

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 webs. Supraglottis was distorted due to multiple adhesions to surrounding structures.

Management

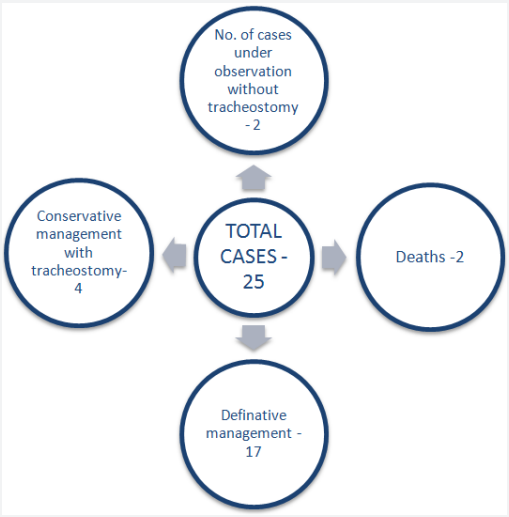

Figure 7:

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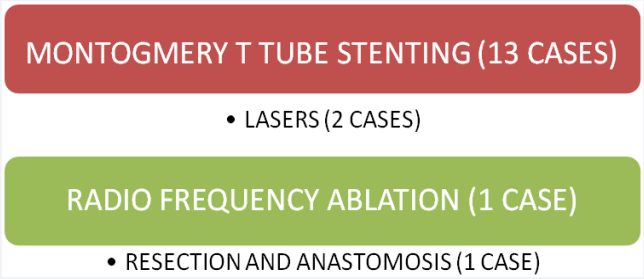

Figure 8:

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 (Figure 7). 17 cases were managed surgically by various modalities which are given below (Figure 8).

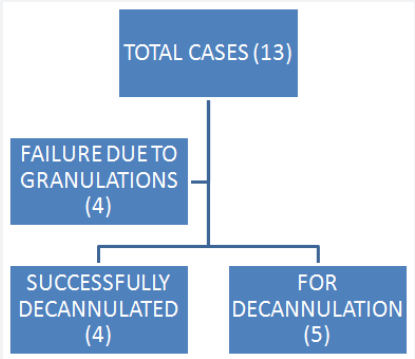

Figure 9:

T-tube management is commonly practiced at our institute for varied reasons among which the results are as mentioned below (Figure 9) (Table 7).

Table 7:

Nature of complication	Incidence
Granulations of trachea	30%
Recurrence due to early removal of stent	7.50%

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 (Table 8).

Table 8:

% of stenting cases succeeded	9 out of 13 – 70%
% of LASER and RESECTION & ANASTAMOSIS cases succeeded	3 out of 3 – 100%
% of deaths	2 out of 25 – 8%
% of cases managed conservatively without tracheostomy	2 out of 25 – 8%
Overall success %	15 out of 25 – 60%

Discussion

In this current study, 25 cases 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 shahnazafrosa et al. [22]. 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. [12] and Mehta et al. respectively 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 [23].

MacEwen first reported endotracheal intubation for anesthesia in 1880 [25]. Lindholm reported injuries to the larynx and trachea after intubation in 1969.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 & McCluskey et al. [25] supporting this study where diagnosis after extubation ranged from 5 days to 1 year. 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 & Sarmista de et al. [26] 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 extent from a fissure in the anterior trachea or grow into a bulky granulomatous formation surrounding a fracture cartilage [27]. On comparision tracheostomy induced stenoses were relatively lesser than post intubational stenosess 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 & G Sethi [18] in 1969 which shows development of tracheal lesion after 36 hours of intubation.

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The determinant of treatment methods is whether post-intubation 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 [28]. So it is concluded that the period between extubation and development of symptoms is very informative in the management of post-intubation 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 thereafter as mentioned in Braidy et al. [29]-" 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 [30] following stenotic segment release either by cold steel technique or radiofrequency ablation followed by stenting with Montgomery T-tube of which 9 cases (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) [31]. 4 out of 13 cases in this study developed granulations after stenting.

Both in vitro and in vivo, Mitomycin C have been proven to be a potent inhibitor of human fibroblasts at concentrations of 0.04mg/L. It has been used with some success in inhibiting the vigorous granulation response noted after airway injury in animal models and pediatrics [32]. 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 [33]. 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. 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. [34]. Even in this study 2cases of tube blockage have been reported when emergency removal of t tube had to be done . Apart from other modalities of treatment, as considered by Puma et al. [35], T tube stenting is one of the best alternatives. Silicon T tube stenting is not just for primary management but can also be used to support the reconstructed airway after laryngotracheal resections and complex stenoses. But in this study all cases were stented as a part of primary management only. Subjects on silicon tube were decanulated between 12-24 months which is well between the span as suggested in Fransesco and colleagues as 9-70 months [35].

In this current study 2 cases 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. [36]. Resection and an astamosis done in 1case is doing equally good without any recurrence.

Many papers and articles by Grillo, Mehta, Mccaaffrey 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 comparisions are limited to it. "T-tubes are a satisfactory alternative 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 [37]. "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 et al. [38]. 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". Kuoshungliu 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 [39].

Conclusion

i. Post intubational airway stenosis – most common cause. Shortest span of intubation-2days ; longest span of intubation-17days ; median span of intubation – 9 days.

ii. Post intubational stenosis;onset of symptoms. Earliest-5days after extubation; maximum duration- 1year after extubation.

iii. As tracheostomy was commonest & earliest intervention to save life,regaining normal sound production was common desire of all the patients.

iv. T-tube stenting is the best and relatively cheaper mode of treatment for selective lesions.

v. Regular humidification & frequent suctioning with NAHCO3 in initial stages may be required to prevent T-TUBE blockage by dry crusting.

vi. T-Tube suctioning is practically difficult for the patient who got used to cleaning the inner tube of silver jackson's.

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vii. All those cases which developed granulations after stenting were aged less than18years.

viii. 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.

ix. Application of topical mitomycin c for 6min after excision of granulations by radiofrequency/electrocautery reduced the incidence of granulations.

x. LASER- usage for this kind of cases is the best alternate to prevent reccurence, but needs experienced practiotioner and it is a costly procedure.

xi. RESECTION & ANASTAMOSIS is best procedure for selective lesions but only in hands of a well trained surgeon.

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