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ORIGINAL ARTICLE

An Analytical study on the Presentation and Outcomes of Laryngotracheal Stenosis in Patients following Intubation & Tracheostomy

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Abstract

Introduction: Laryngotracheal stenosis (LTS) is a complex condition that results in a compromised airway, involving trachea and/or larynx. The etiology of LTS has changed over the years, the common cause now being iatrogenic; post-intubation and post-tracheostomy. Objective of this Study is to analyze, the clinical presentation and outcomes, following management of LTS.

Methods: This study was carried out as a Retrospective study .Review and Reports of 200 cases /patients, who were diagnosed as LTS and surgically managed by various Tertiary Medical Institutes and Hospitals over a period of 1 year were included in the study. Data relating to the types of intervention, complications, and outcome were documented, filled and statistically analysed

Results: Main etiology of LTS was Endotracheal Intubation in 83 % (166) cases and rest were (17%) Post Tracheostomy. The predominant site of stenosis in endotracheal intubated patients is the Tracheal (75.3%) & Subglottic and Upper Tracheal (18%) followed by glottis (6.6%). In Post Tracheostomy / Tracheostomized Cases the Predominant site was Suprastomal. 105 patients (52.5%) underwent T-tube stenting with Montgomery T-tube (temporary and permanent).
93% of the patients with LTS were managed successfully with a good outcome, 2% failed on T-tube, and 2.5 % awaiting decannulation. The overall success is more with resection and anastomosis procedures. laryngeal protective mechanisms were well preserved in above 89% of the patients with a satisfactory result.

Conclusion: Management of LTS is a challenge. The procedure of choice is tracheal resection and anastomosis for tracheal stenosis but when the glottis and/or the subglottis is involved The progress of resuscitation with improving care for ventilated patients has led to a marked decrease in the incidence of tracheal stenosis compared to the previous years.

Keywords: Laryngotracheal Stenosis, Retrospective evaluation, Endotracheal Intubation, Tracheostomy

1 | INTRODUCTION

Laryngotracheal stenosis (LTS) is a complex condition that results in a compromised airway, involving trachea and/or larynx. The etiology of LTS has changed over the years, the common cause now being iatrogenic; post-intubation and post-tracheostomy. Stenosis can occur anywhere from the level of the endotracheal tube tip up to the glottic and subglottic area, but the most common sites are where the endotracheal tube cuff has been in contact with the tracheal wall and at the tracheal stoma site after a tracheostomy procedure. Thus, tracheal stenosis can most commonly occur following the two types of airway intubation: endotracheal intubation and tracheostomy .

The reported incidence of LTS following laryngotracheal intubation and tracheostomy ranges from 6% to 21% and 0.6% to 21%, respectively.[1,2] In the study by Herrak and Ahid, the incidence was as high as 55.17% post-intubation and 44.82% post-tracheostomy.[3] Deaths resulting from complications associated with artificial airways suggested the need to implement systematic monitoring to detect and treat these complications. Complications of translaryngeal intubation and tracheostomy have been reported by anesthetists,[4,5] otorynolaryngologists,[5,6] who are increasingly involved in the long-term management of such patients. Estimations of the incidence of complications vary. Some complications, such as sore throat or hoarseness after intubation, are frequent but benign,[7] whereas the occurrence of stenosis of the airway may be life threatening.[8] In endotracheal intubation, LTS is caused either by the mechanical trauma of placement of an endotracheal tube or its contact pressure. Mucosal hyperemia and edema will result in mucosal necrosis secondary to compression of capillaries in the tracheal mucosa causing ischemia; which is observed within hours of intubation and can result in exposure of the perichondrium of the cricoid cartilage. The resulting perichondritis secondary to infection will lead to healing with scar formation.

The evolution of early injury into stenosis depends on local and systemic factors. Ischemia of the mucosa results from the pressure exerted by the tube and especially its cuff, and on the systemic blood pressure [9] Local infections and general conditions, such as the administration of steroids[8] or the presence of diabetes mellitus, may also play a role[10]

Myer et al.[11] devised a classifi cation scheme from I to IV for grading circumferential subglottic stenosis. This grading system applies mainly to circumferential stenosis. Grade I: <50% luminal obstruction and Grade II: 50-70% luminal obstruction. Grade III: 71-99% luminal obstruction and Grade IV: Decannulation on the basis of the anatomic location of the stenosis. 90% Grades I and II, 70% of Grade III and 40% of Grade IV patients are successfully decannulated. As there is no standard recommended procedure that gives consistent results. Hence, various techniques and surgical procedures are described to manage LTS . Studies comparing translaryngeal intubation and tracheostomy[12] that consider the duration of intubation and the timing of tracheostomy[5] the optimal timing for these interventions remains subject to debate. The discrepancies in results may be attributed to differences in the patient populations, the types of complications, and the procedures used for follow-up.

Objective of this Study is to analyze, the clinical presentation and outcomes, following surgical management of LTS.

2 | METHEDOLOGY

This study was carried out as a Retrospective Evaluation study .Review and Reports of 200 cases /patients, who were diagnosed as LTS and surgically managed by various local secondary / Tertiary Medical Institutes and Hospitals over a period of 1

Supplementary information The online version of this article (https://doi.org/10.15520/ijmhs.v10i08.3166) contains supplementary material, which is available to authorized users.

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year from 2017 to 2018 were included in the study. The Hospitals and Tertiary Medical Institutes were Randomly Selected . Data and Case files / Reports were duly obtained after the permission of Medical Superintendent of the respective Hospitals after fulfilling the conditions of maintaining Professional Secrecy of the cases / Patients. The medical charts of 200 patients who had undergone laryngotracheal intubation and tracheostomy were included in this retrospective analysis. The decision to intubate or perform a tracheostomy was made by the ICU staffs of the respective Hospitals and Medical Institutes , who were unaware that there would be a retrospective analysis.

In all the data acquired , Demographic data was taken for each case / patient: age, sex, body mass index (BMI), co-morbid conditions and corticosteroid therapy received. The following data regarding the tracheal stenosis were also obtained: the circumstances leading to the development of tracheal stenosis (Post Intubation versus Post Tracheostomy), type of stenosis (web-like stenosis, granulation tissue formation, tracheomalacia) and the therapeutic interventional pulmonary procedure(s) performed.

Each patient had underwent a standard pre-operative assessment, including physical examination, routine laboratory tests, chest radiography and computed tomography of the chest. An initial diagnostic flexible bronchoscopy (FB) was performed for each patient to identify the type, location and severity of the stenosis. The stenosis was characterized severe if it was causing symptoms, primarily dyspnea, was complex in nature (stenosis combined with cartilage fracture or tracheomalacia) and the obstruction of the tracheal lumen exceeded 50%. The degree of stenosis was estimated with a dedicated instrument that was used to measure the diameter of the stenotic area and the diameter of the trachea lumen before and after the stenotic site. In some later cases the stenosis was estimated by virtual bronchoscopy along with the dedicated measuring device. All the suspected cases of LTS were evaluated initially by a rigid or a flexible laryngeal endoscopy and the site of stenosis, degree of luminal narrowing, the length and type of stenosis and the involvement of glottis, supraglottis, or subglottis noted. In tracheostomized patient, the stomal and supra or infrastomal were evaluated. Radiological data of computed tomography neck were obtained where necessary. Data relating to the types of intervention, complications, and outcome were documented and filled and statistically analysed filled in Microsoft Excel & analysed using a computer software Epi Info version 6.2 (Atlanta, Georgia, USA) and SPSS (SPSS Inc., Chicago, Illinois, USA). version 20. P value of 0.05 and less was considered as statistically significant.

3 | RESULTS

Out of the total 200 case reports the main etiology of LTS was Endotracheal Intubation in 83 % (166) cases and rest were (17%) Post Tracheostomy The population included Prdominantly 78% males. The mean age was 35.6 years (range, 6 to 86).

The mean duration of mechanical ventilation was 16 days (Range 1 to 38 days)

The causes that triggered the intubation and/or tracheotomy are known and classical causes, with, at the forefront, an acute respiratory failure in 23 % of cases (46 patients). These patients do present exacerbations with chronic obstructive lung diseases , of their asthma or having acute respiratory distress.

In the second place were neurological injuries (20%) including cerebral vascular accidents (CVA), brain hemorrhage, head injury and coma of diverse etiologies; 19% were for a previous surgery, 17 % patients were victims of Heart disease Accidents, 11 % patients had heart diseases , 6% cases were of attempted suicide and 5% patients had a burn extent.

Table 1 shows the Site of Stenosis in Endotracheal Intubated cases. The predominant site of stenosis in endotracheal intubated patients is the Tracheal (75.3%) & upper trachea (18%) followed by glottis (6.6%).

Regarding the management of the 200 patients with LTS, 105 patients (52.5%) underwent T-tube stenting with Montgomery T-tube (temporary and permanent). 6 cases (3%) of the temporarily stented patients had to be stented permanently secondary to the development of complications (e,g Tracheomalacia).

TABLE 1: Site of Stenosis in Endotracheal Intubated cases

Site of Stenosis	Supra-glottis	Glottis	Subglottic & Upper Tracheal	Tracheal	To-tal
Total No. of Endotracheal Intubated Cases	0	11 (6.6%)	30 (18.0%)	125 (75.3%)	166

TABLE 2: shows site of stenosis inPost Tracheostomy / Tracheostomized Cases . The Predominant site was Suprastomal(Subglottic & Upper Tracheal)

Site of Stenosis	Infras-tomal	Stomal	Suprastomal (Subglottic & Upper Tracheal)	To-tal
Total No. of Post Tracheostomy Cases	0	0	34 (100%)	34

32 cases (16%) undergo tracheal resection and anastomosis , 9% (18 cases) went for Cricotracheal resection & anastomosis . 5 cases had posterior glottic and subglottic stenosis and underwent excision of the scar tissue followed by Hoods laryngeal stenting. 30 cases (15%) had ND-YAG Laser assisted excision. The other procedures performed were keel stenting, Bougie dilatation, Laser assisted scar excision, and anterior cricoid split with hyoid interposition.

Of the patients who underwent T-tube stenting, the stent was successfully removed in 88 % and are stable in 1-year follow-up period, 3% of them are awaiting decannulation and 9 % failed decannulation secondary to tracheomalacia & development of stenosis at upper and lower end of tube after decannulation.

Following resection and anastomosis, 94% had successful outcomes. The patients who underwent cricotracheal resection and anastomosis had a 100% successful outcome.

Considering all the surgical procedures, 93% of the patients with LTS were managed successfully with a good outcome, 5 cases (2.5%) failed on tracheostomy, 2% failed on T-tube, and 2.5 % awaiting decannulation. The overall success is more with resection and anastomosis procedures.

Long term review showed that the airway, voice, and laryngeal protective mechanisms were well preserved in above 89% of the patients with a satisfactory result.

4 | DISCUSSION

Management of LTS is a challenge. LTS is one of the most frequent complications associated with prolonged naso/orotracheal intubation and tracheostomy, such as in intensive care units.[13]

The site of the stenosis varies according to the etiology. Post-intubation stenosis tends to develop web-like fibrous stenosis at the cuff site while tracheostomy patients develop stenosis due to granulation tissue around the stoma site.[14]Furthermore, patients in the elective tracheostomy group would be intubated for longer periods, thus exposing them to more traumas at the tracheal stoma site, and risk of infection.[14] The cuffed endotracheal tube will cause mucosal erosion, pressure necrosis, and if in situ for a long time may cause perichondritis. Once withdrawn, the mucosa heals completely within a month and is replaced by metaplastic squamous epithelium and underlying fibrosis. In very severe ulceration involving prolonged intubation and superadded secondary bacterial infection, the risk of LTS is very high. With the advent of high-volume low-pressure cuff, tracheal stenosis at cuff site has reduced.

In this Study Review and Reports of 200 cases /patients, who were diagnosed as LTS and surgically managed by various local secondary / Tertiary Medical Institutes and Hospitals over a period of 1 year.

The medical charts of 200 patients who had undergone laryngotracheal intubation and tracheostomy were included in this retrospective analysis. The

decision to intubate or perform a tracheostomy was made by the ICU staffs of the respective Hospital.

Out of the total 200 case reports the main etiology of LTS was Endotracheal Intubation in 83 % (166) cases and rest were (17%) Post Tracheostomy. The predominant site of stenosis in endotracheal intubated patients is the Tracheal (75.3%) & upper trachea (18%) followed by glottis (6.6%). The Predominant site was Suprastomal (Subglottic & Upper Tracheal) in Post Tracheostomy / Tracheostomized Cases.

Most authors mention two basic modalities for treatment of LTS - endoscopic and external approach.[15] The procedure of choice is tracheal resection and anastomosis for tracheal stenosis.[16] However, when the glottis and/or the subglottis is involved this surgical approach may not be applicable; moreover it may not be feasible due to the extent of stenosis, underlying disease and general health of the patient.[17] Most of the patients in the series were from the intensive care set up with a poor general health condition and multiple comorbidities where extensive/ major surgeries such as resection and anastomosis could not be performed. The second, some patients had already undergone multiple surgeries before they presented to us, and some patients had economic constrains. These patients were managed by either a temporary or permanent stenting with Montgomery T-tube. The tracheal T-tube was introduced in 1965 by Montgomery,[18] which acts as stent maintaining airway patency and a tracheostomy tube, made of silicone. It does not harden at body temperature.[19] It is easy to introduce and maintain and cheaper compared to other stents.[20] The ideal duration of T-tube stenting according to Cooper et al.[21] is 6-12 months whereas Martinez-Ballarin et al.[22] has recommended usage up to 18 months However, there are some complications with T-tube. Some experienced surgical emphysema, severe crusting of the tube in another, when replaced the tube and formation of granulation at either ends of the tube or sometimes resulting in restenosis

5 | CONCLUSION

105 patients (52.5%) underwent T-tube stenting with Montgomery T-tube (temporary and permanent). Following resection and anastomosis, 94% had successful outcomes. The patients who underwent cricotracheal resection and anastomosis had a 100% successful outcome.

Considering all the surgical procedures, 93% of the patients with LTS were managed successfully with a good outcome, 5 cases (2.5%) failed on tracheostomy, 2% failed on T-tube, and 2.5 % awaiting decannulation. The overall success is more with resection and anastomosis procedures. Long term review showed that the airway, voice, and laryngeal protective mechanisms were well preserved in above 89% of the patients with a satisfactory result. The progress of resuscitation with improving care for ventilated patients has led to a marked decrease in the incidence of tracheal stenosis compared to the years 1970–1980. That is to say that, anyway, the assumption of after tracheal intubation stenosis and/or after tracheotomy can require a multidisciplinary collaboration between Surgeons / ENT Surgeons , Respiratory physicians / anaesthetist, thoracic surgeons, radiologists and intensive care physicians.

Compliance With Ethical Standards.

Conflict Of Interest – None.

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Consent Obtained.

(1–22)

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