



CODEN [USA]: IAJPB

ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

<http://doi.org/10.5281/zenodo.3262223>

Available online at: <http://www.iajps.com>

Research Article

KNOWLEDGE OF ETIOLOGY OF TRACHEAL STENOSIS AND ESTIMATE OUTCOME OF TRACHEAL RESECTION AND END-TO-END ANASTOMOSIS FOR TRACHEAL STENOSIS

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Article Received: April 2019

Accepted: May 2019

Published: June 2019

Abstract:

Objective: To know the etiology (causes) of tracheal stenosis and estimate outcome of tracheal resection and end-to-end anastomosis for tracheal stenosis.

Design: Descriptive prospective case series.

Place and Duration: Department of thoracic surgery, Services Hospital, Lahore from May 2014 to March 2019.

Patient and Methods: Twenty-two patients were involved in the study that go through the process of dividing trachea into part combining them again by the same surgical team. Etiology (causes) was found out on the basis of available history pre-operative findings. The process is done by using VICRYL 3/0 (medicine name) outcome of surgical technique estimated top expiratory-flow-rate and flexible bronchoscopy.

Results: Twenty-two patients were managed over a period of five years, of which 17 (77.3%) were male and 5 (22.7%) females. Mean patient age was 27.31±9.61 years. Seven (31.8%) patients had New York Heart Association grade (NYHA)-III and 15 (68.2%) had NYHA grade-IV dyspnea. Seventeen (77.3%) had stridor. All patients were already being managed by pulmonologists, ENT specialists or intensivists. Twelve (54.5%) had Grade-V stenosis (91-100% luminal obstruction) and 9 (40.9%) had grade-IV stenosis (76-90% obstruction). Six (27.3%) patients had subglottic stenosis, 13 (59.1%) had cervical tracheal stenosis and 3 (13.6%) had mediastinal tracheal stenosis. Six (27.3%) patients had partial cricoid resection followed by thyrotracheal anastomosis, 13 (59.1%) patients underwent cervical tracheal anastomosis and 3 (13.6%) patients required mediastinal tracheal anastomosis. Patients were followed up post-operatively for the development of immediate and delayed complications. The follow up was carried out for a minimum period of 6 months to a maximum period of 2 years. Postoperative complications included neck pain, lung collapse, and superficial skin infection.

Conclusion: The process of division and then recombining the parts of trachea is safe, reliable and permanent procedure for the treatment of tracheal stenosis.

Key Words: Tracheal stenosis, Reconstruction, Trachea, Tumor, Complications.

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Please cite this article in press Syed Faheem Ahmed Gardazi et al., Knowledge Of Etiology Of Tracheal Stenosis And Estimate Outcome Of Tracheal Resection And End-To-End Anastomosis For Tracheal Stenosis., Indo Am. J. P. Sci, 2019; 06[06].

INTRODUCTION:

Trachea is a compressible tube passing through neck and chest cavity. which is specialized for air conduction, saturation by humidity, for loos hook and is also used as a primary defense mechanism for microbes for lungs. Closing of this tube may result in tracheal stenosis, causes of which may be natural and acquired; involving lumen, in the lumen or outside it. Mechanical ventilation is a big reason for this disease initially because of prolonged intubation or tracheostomy. Number of patients is increasing with serious disease like dyspnea, stridor or recurrent chest infections. This disease does not have specific symptoms; instead of tracheal stenosis patients are cured and treated for refractory bronchial asthma.

Colles described 4 cases of tracheal stenosis in 1886 after tracheostomy in 57 children with diphtheria. Some procedures are as follows tracheal incision, exclusion, tracheoplasty, resection/anastomosis, grafts, flaps etc. In this time when the surgery is very advanced such as dilatation, stenting and endoscopic/laser resection flourished. The goal of treatment is a clear, uncollapsible tube sufficient for lumen having no need of changing again and again or associated injury. Resection of tracheal stenosis with initial end- to-end anastomosis can be done by any related procedure.

Tracheal resection/reconstruction is a very special process and it demands a very special team such as tracheal surgeon, anesthesiologist, pulmonologist and intensivist. Tracheal resection with end-to-end anastomosis was started in 2014 in department of Thoracic Surgery, Services hospital, Lahore. No original study on tracheal resection & end-to-end anastomosis has ever been published for last 63 years from Pakistan since its creation. Keeping in view of uncommon disease nature and increasing rate, lack of management facilities as well as lack of original studies from Pakistan, possible study was carried out with the objective to know the causes of tracheal stenosis as well as to evaluate the outcome of tracheal resection surgery in our center.

MATERIAL AND METHODS

Tracheal resection surgery in our center was started on regular basis in 2014. All guide with a doubt of tracheal stenosis was performed. History of present illness with hardness, duration, association of dyspnea strider, cough, sputum and fever was taken. Past history of airway interference (trauma, tracheostomy, endotracheal intubation and dilatation) was taken. Associated topics like recent mechanical ventilator support, polytrauma, head injury, diabetes mellitus,

pneumonia and neurological disease was also noted. systemic examination of throat, neck and chest was done. All patients were admitted, and routine survey were done. Neck/chest x-rays and CT scan with 3D reconstruction of tracheobronchial tree were requested. Airway stenosis classification system by Freitag was used. Flexible/rigid bronchoscopy was done in all patients and length, site, harshness of stenosis, distance from vocal cords and cord movement was noted. There was some patient with some other diseases like webs, edema, acute granulation, tracheal tear and cartilage fracture. These patients were excluded and only the patients with tracheal stenosis were included. Chest physiotherapy was done with every patient and some other programs like motivational, nutritional builds up was done in every department with every patient. And also, workout was done every day. Patients was advised and there complains were noted. Anesthesia was given them by tracheostomy. And an exact type of stenosis was confirmed. Tracheal stenosis was studied within pretracheal fascia. The effected part of trachea was opened, and endotracheal tube was passed. Stenosis portion was opened surgically up to healthy portion. Movement of suprahyoid muscles was allowed where it was necessary. Posterior anastomosis was done by using polygactin structures (figure 2). Anterior anastomosis was done after passage of Oral armored endotracheal tube (Figure 3). Puncture test was done to confirm airtight anastomosis. Anastomosis was covered with thyroid isthmus. After closing of outer layer of skin guarding stitches was applied. Removal of endotracheal tub(ETT) after few hours in ITC. Neck staples were removed after first week and guarding stitches after three weeks. Regular follow-up was ensured, and all pertinent data was maintained on SPSS 21.

RESULT:

Twenty-two patients of confirmed tracheal stenosis were added in process of five years. Seven were male. Five were female. Eleven had tracheal stenosis of less than 10mm. Twelve had Grade-V luminal abstraction and 9 had grad-IV and 1 had gradIII. Causes are shown in figure 4. Ten patients had ETT (endotracheal tube) for of mechanical ventilation. Five had endotracheal intubation as well as tracheostomy was done.3 patients had tracheal tumors. Tracheostomy was the only cause of stenosis in 2. One (4.5%) had endotracheal intubation for ventilator support after head injury; followed by tracheostomy. Attempts for decannulation of tracheostomy failed multiple times; after which a T-Tube was placed in addition to tracheostomy. One (4.5%) had primary larynotracheal trauma resulting in stenosis.

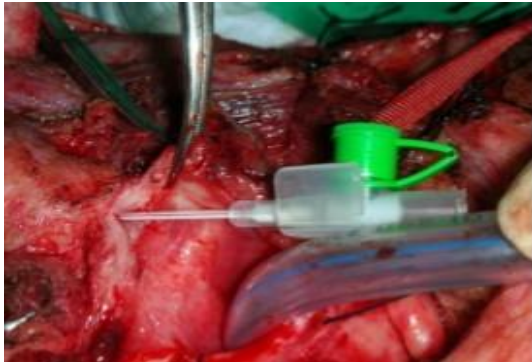


Figure 1: Grade-v tracheal stenosis with 18-g cannula

Resection and anastomosis were carried out in all patients. Eighteen patients were approached through cervical collar crease incision. Three patients required sternal-split for mediastinal tracheal resection /anastomosis. One patient was approached through right thoracotomy for stenosis caused by lower tracheal tumor.



Figure 2: Posterior tracheal anastomosis done with orotracheal armour tube in place

Crico- tracheal anastomosis for subglottic stenosis was done in 6 (27.3%) patients. Tracheo-tracheal anastomosis for upper cervical stenosis was done in 13 (59.1%) patients. Mid/lower tracheo- tracheal anastomosis was done in 4 (13.6%) Anteroposterior tracheal release was done in all patients while supra-hyoid release was done in 15 (67.7%) patients.



Figure 3: Anterior Tracheal Anastomosis

Outcome of our surgical technique was compared with immediate and late results. First of all, some patients were ventilated for 24-48 hours. But later with the passage of time on-table extubation was done in last 12 (54%) patients without need for re-intubation speaking of the sufficient tracheal lumen postoperatively. After three weeks, once neck guarding stitches were removed. Postoperative PEFR was noted at that time; which in our series showed remarkable improvement. After three months all patients were tested for their tracheal stenosis. All patients had almost normal tracheal lumen except for two patients who required temporary tracheostomy. The process of cure was done in the time of 6 months to 2 years. After two years, six monthly telephonic follow-ups of each patient is maintained to date.

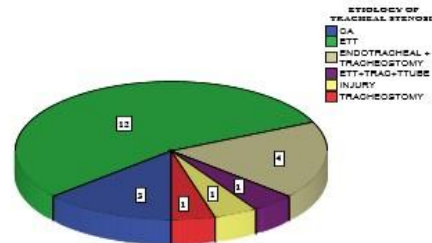


Figure 4: Etiology Of Tracheal Stenosis

There were some complications which include neck pain in 10 patients probably due to flexed neck posture for 2-3 weeks. Two patients had lung collapse which were managed carefully by antibiotics, bronchoscopy lavage and physiotherapy. One patient with subglottic stenosis had laryngeal edema, managed with tracheostomy for two weeks. One diabetic patient had anastomotic granulation, managed successfully with tracheal T-Tube placement for three months. One patient had Pneumonia and sacral bed sore. One patient had radial artery thrombosis after arterial line entry, which reacted well to anti-coagulation. No major problem like anastomotic leak, fistula or recurrent stenosis was noted.

DISCUSSION:

Rate of tracheal stenosis has been increased due to following reasons iatrogenic airway trauma by intubation, tracheostomy and mechanical ventilator support. Cannulation is a main cause of stenosis at cuff site. Cuff pressure above a certain level such as more than 30 mm Hg can leads to ischemia, ulceration, cartilage damage, chondrites, fibrosis and scarring. Low pressure-high volume endotracheal tubes, is a main reason and factor of stenosis with an incidence of 6-21%. Stenosis after tracheostomy is increased by the following reasons; Tracheal cartilage damage at stoma site, tube tip and posterior curve along with large size tube, too much force applied and large stoma, wound sepsis with an incidence range 0.621%. Any patient who have faced mechanical ventilator and developing upper airway obstruction has tracheal stenosis unless proved otherwise. To confirm the exact cause of stenosis is difficult in patients primarily cannulated followed by tracheostomy. Cannulation(intubation) and tracheostomy are two main causes of stenosis and are responsible for stenosis in 77% of our study population.

The patients have nonspecific symptoms for stenosis but through cough and respiratory tract infection frequently occur. That's why they are often treated for asthma and minimal airway blockage years later. Know many classes have been evolved with the passage of time such as; Cotton Myers, Grundfast, McCaffrey etc; however, we used tracheal stenosis grading by Freitag et al in our study. Flexible/rigid bronchoscopy through nasal/tracheostomy route is required to confirm site, length, grade of stenosis and vocal cord function. CT scan with virtual bronchoscopy is becoming a popular non-invasive tracheo-bronchial tool with high sensitivity.

Because of lake in number of surgeons practicing tracheal surgeries. Reconstructive tracheal surgery

evolved very late because of disease stenosis being relatively rare, week healing capacity of tracheal cartilage, having trouble in maintaining ventilation during tracheal resection. Rare nature of tracheal stenosis is stated in different studies in international literature. Today, no local study on the primary tracheal resection and reconstruction is access able in Pakistan. Air duct surgery is a team work of expert tracheal surgeon and specialists. All of patients in our study undergone tracheal resection followed by primary end-to-end anastomosis using the basic principles of tracheal surgery. And we achieved Success rate of 100% and is comparable to many international studies. No major problems like recurrent laryngeal nerve injury, anastomotic leak or tracheo-innominate fistula was encountered in our study. Just 2 patients in our study needed limited tracheostomy after which they recovered notably. Patient – fitness follow-up procedure was used in our study. Six monthly physical test was done for two years. Then six monthly telephonic follow up was done to confirm any problem in breathing and stridor. Till to-date none of our patient has repeated stenosis or any other associated illness. Applying least invading techniques like serial dilatation, lasers, cryotherapy, micro-cauterization, intra-lesion steroids and stents which are usually reserved for patients unsuitable for general anesthesia, elderly, minimal stenosis, recurrent stricture following surgery and noncompliant patients but none of these was analyzed in our study.

Our study is based on a least sample size due to many cases, lack of information about development of stenosis including patients as well as physicians, not to able to compare resection with other minimal invading techniques, All these problems need to be addressed in some bigger studies in future.

CONCLUSION:

Careful functional planning, careful dissection, excellent functional air duct control and communication between operating surgeon, specialist and care provider are necessary for safe and successful outcome after tracheal resection and primary end-to-end anastomosis.

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